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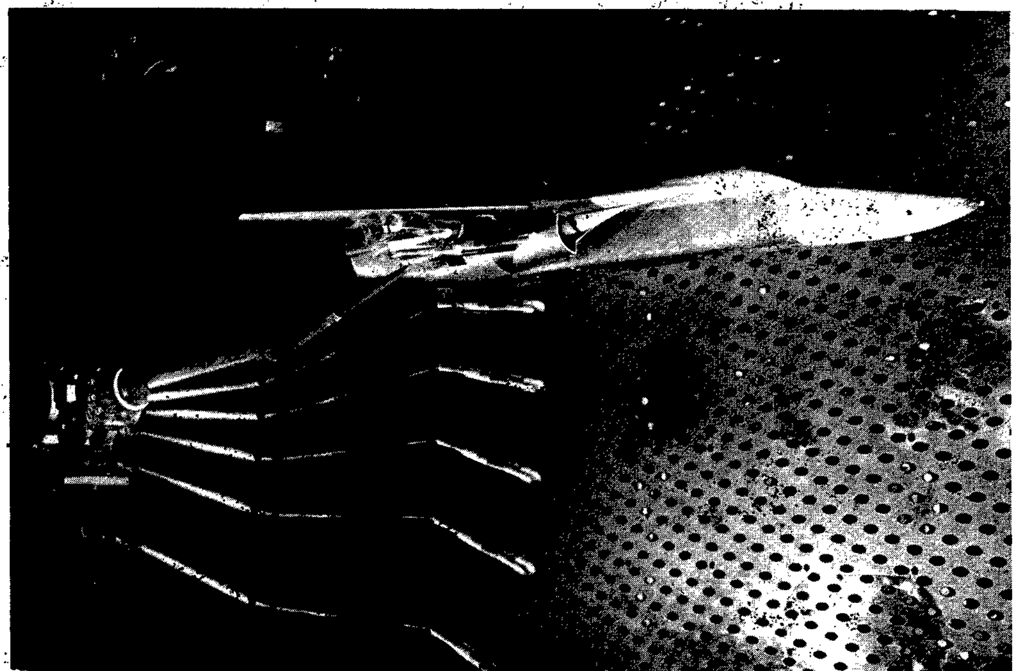

User Requirements and Information for Captive Trajectory and Grid Testing in the PWT Aerodynamic Wind Tunnels (4T/16T/16S)

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PROPULSION WIND TUNNEL FACILITY

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ABSTRACT

The information contained herein includes a listing of the input data necessary to conduct on-line captive trajectory and grid testing, definitions of the standard coordinate axis systems used in the data presentation, and a listing of the standard and operational parameters available for both tabulated, plotted, and magnetic tape data output. This will serve as a guide to the User as to the information needed by PWT personnel to prepare for a captive trajectory and/or grid test.

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SECTION I

GENERAL USER INFORMATION AND REQUIREMENTS FOR CAPTIVE TRAJECTORY AND GRID TESTING IN THE PWT AERODYNAMIC WIND TUNNELS (4T/16T/16S)

The information contained herein includes a listing of the input data necessary to conduct on-line captive trajectory and grid testing, definitions of the standard coordinate axis systems used in the data presentation, and a listing of the standard and optional parameters available for both tabulated and plotted data output. This will serve as a guide to the User as to the information needed by PWT personnel to prepare for a captive trajectory and/or grid test, and as to the available data output variables and formats. In order to minimize both preparation time and the opportunity for incorrect program instructions, standardized notation has been developed for both input and output data. User-supplied input data should be provided using the notation described herein. Tabular data will be provided to the User in the notation described, and shown on the attached sample printout sheets. To the maximum extent possible, the notation and definitions in this presentation are the same as those used in dynamic drop separation test programs, which are described under separate cover.

Summary data tabulations and hard copy plots of the type shown herein are generally available for review within a few minutes after a trajectory/grid has been completed. Early and complete specification of the parameters desired for on-line analysis is important to assure that the proper formats are available during the test. Several parameters may be displayed on a cathode ray tube (CRT) in the control room on a real-time basis as the data are acquired.

In addition to the on-line data output, off-line data review can be provided through an interactive graphics terminal tied into the AEDC central computer system (an AMDAHL 5860). This terminal has a CRT display and a hard copy plotting attachment. Test data can be entered into the data base for this system either by direct transmission from the on-line computer after each run, or by batch data entry from magnetic tape at some later time. Several sets of data may be displayed simultaneously on this terminal for data comparisons. A guide to the use of this system can be supplied on request.

A more detailed description of all the AEDC store separation test capabilities may be found in the Technical Report, AEDC-TR-79-1. This is a four-volume series entitled "Store Separation Testing Techniques at the Arnold Engineering Development Center." Subtitles of the four volumes are:

Volume I	An Overview
Volume II	Description of Captive Trajectory Store Separation Testing in the Aerodynamic Wind Tunnel (4T)
Volume III	Description and Validation of Captive Trajectory Store Separation Testing in the von Karman Facility
Volume IV	Description of Dynamic Drop Store Separation Testing

SECTION II

REQUIRED INPUT DATA

2.1 General

This section defines parameters which are required as program input data. Some of the items will remain constant throughout a test, some will vary only with changes in store configuration, and some will vary with each trajectory or grid.

2.2 Full-Scale Store Dimensions (Trajectory and Grid)

λ	Aircraft model scale factor
k_λ	Ratio of store scale to aircraft scale (normally equals 1)
A	Store reference area, ft^2, full scale
ℓ_1, ℓ_2, ℓ_3	Store full-scale reference dimensions for pitching-moment, yawing-moment, and rolling-moment coefficients, respectively, ft
ℓ	Store length, ft, full scale (Trajectory only)
X_{cg}	Axial distance from the store nose to cg location, ft, full scale
Y_{cg}, Z_{cg}	Lateral and vertical distances from the store reference (balance) axis to the cg location, positive in the positive Y_B and Z_B directions, respectively, ft, full scale

2.3 Full-Scale Store Mass Parameters (Trajectory)

Wt	Full-scale store weight, lb
I_{XX}, I_{YY}, I_{ZZ}	Full-scale moments of inertia about the store X_B, Y_B, and Z_B axes, respectively, slug-ft^2
I_{XY}, I_{XZ}, I_{YZ}	Full-scale products of inertia in the store X_B-Y_B, X_B-Z_B, and Y_B-Z_B planes, respectively, slug-ft^2
$\Delta X_{m,cg}$	Axial distance from store cg to the measured pitching-moment coefficient reference center, positive in the positive X_B direction, ft, full scale (see Fig. 1)
$\Delta X_{n,cg}$	Axial distance from the store cg to the measured yawing-moment coefficient reference center, positive in the positive X_B direction, ft, full scale (see Fig. 1)

2.4 Store Aerodynamic Coefficients (Trajectory)

$C_{\ell_p}, C_{m_q}, C_{n_r}$	Store roll-damping, pitch-damping, and yaw-damping derivatives, respectively, per radian
$C_{A,o}, C_{N,o}, C_{Y,o}$	External input axial-force, normal-force, and side-force coefficients, respectively
$C_{\ell,o}, C_{m,o}$ $C_{n,o}$	External input rolling-moment, pitching-moment, and yawing-moment coefficients, respectively

2.5 Thrust Force Simulation (Trajectory; see Fig. 2)

$F_{T,X}$	Simulated full-scale store thrust in the positive X_B direction, lb; $F_{T,X}$ versus time required, tabular values or curve
X_0, Y_0, Z_0	For lanyard length calculations, offset of the store center of gravity from the lanyard attachment point on the store in the positive X_B, Y_B, and Z_B directions, ft, full scale
X_1, Y_1, Z_1	For lanyard length calculations, offset of the store center of gravity at carriage from the lanyard attachment point on the aircraft in the positive X_B, Y_B, and Z_B directions, ft, full scale
Z_L	Lanyard length, straight line distance between designated reference points on the aircraft and store, ft, full scale
t_D	Time delay required after lanyard limit before thrust initiation, sec
$C_{jd_\ell}, C_{jd_m}, C_{jd_n}$	Store jet-damping coefficients in roll, pitch, and yaw, respectively, ft-sec

2.6 Ejector Force(s) Simulation (Trajectory; see Fig. 3)

F_{E1}, F_{E2}	Forward and aft ejector forces, respectively, lb; F_{E1}, F_{E2} versus distance (or time) required, tabular values or curves
Z_{E1}, Z_{E2}	Ejector stroke length or time of action for forward and aft ejector pistons, respectively, ft, full scale, or seconds
X_{FE}	Axial distance from the store nose to the forward ejector piston, ft, full scale
ΔX_{AE}	Distance between forward and aft ejector pistons, ft, full scale

ω_m	Ejector piston line of action with respect to the store X_B-Z_B plane, positive for clockwise rotation when looking upstream, deg

2.7 Store Initial Conditions (Post-Launch Trajectory)

t_o	Time at trajectory initiation, sec
$X_{I,o}, Y_{I,o}$ $Z_{I,o}$	Distances of the store cg from the carriage location in the inertial axis X_I, Y_I, Z_I positive directions at trajectory initiation, ft, full scale
$\nu_{I,o}, \eta_{I,o}$ $\omega_{I,o}$	Orientation of the store body axis from the inertial axis in a pitch, yaw, roll sequence at trajectory initiation (post-launch only), deg
u_o, v_o, w_o	Store velocities along the positive X_B, Y_B, and Z_B axes at trajectory initiation, ft/sec
p_o, q_o, r_o	Store angular velocities about the X_B, Y_B, and Z_B axes at trajectory initiation, rad/sec

2.8 Flight Conditions (Trajectory)

h	Simulated pressure altitude, ft
N_Z	Aircraft load factor, g's
γ	Simulated aircraft dive angle, positive for decreasing altitude, deg
$\phi_{A/C}$	Simulated aircraft bank angle, positive for right wing down, deg

2.9 Store Motion (Trajectory)

X_o, Y_o, Z_o	For restricted motion cases, offset of the store center of gravity from the rotation center or the aft rail hook in the positive X_B, Y_B, and Z_B directions, ft, full scale (see Figs. 4a and 4b)
$X_{P,1}$	For restricted motion cases 4 through 7, distance store must travel along rail in a translate only mode, ft, full scale (see Fig. 4b)
$X_{P,2}$	For restricted motion cases 5 through 7, distance aft hook must travel along rail before becoming free of rail, ft, full scale (see Fig. 4b)

$\Delta\theta_R$	For restricted motion cases 1, 2, and 3, pitch angle through which store must pivot before release, deg (see Fig. 4a)

2.10 Store/Aircraft Attitude (Trajectory and Grid)

I_Y	Yaw incidence of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose to the right as seen by the pilot, deg
I_P	Pitch incidence of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up as seen by the pilot, deg
I_R	Roll incidence of the store X_B-Z_B plane at carriage with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg
α	Aircraft-model angle of attack relative to the free-stream velocity vector, deg
β	Aircraft-model sideslip angle relative to the free-stream velocity vector, deg
Λ_{LE}	Aircraft-model wing leading-edge-sweep angle, deg
ϕ_S	Roll angle of the store Number 1 fin with respect to the $-Z_B$ axis, positive clockwise looking upstream, deg

2.11 Grid Matrix Information (Aerodynamic Grid)

Origin Location

Orientations and positive directions of grid coordinates

Orientation of store with respect to grid coordinates

Store cg locations with respect to grid coordinates

α_S	Store-model angle of attack, deg (free stream)
β_S	Store-model sideslip angle, deg (free stream)

SECTION III

REQUIRED STORE INITIAL POSITIONING DATA

Information must be supplied to locate the store model on the aircraft model at each position from which trajectories or grid surveys are to be initiated. This is most generally accomplished by specifying the full-scale store attachment lug locations and the corresponding hook locations on the racks and/or pylons of the aircraft. For trajectory data, this information also permits a cross reference of the ejector piston positions (Section 2.6) for the standard aircraft installations. In some cases, specifying lug and hook positions is not feasible, and in these instances other reference dimensions such as fuselage station, butt line, and waterline of the store c.g. may suffice. Whatever set of data is provided, it must uniquely define the store position at carriage and a consistent set of parameters must be used with respect to both the store and the aircraft.

SECTION IV

COORDINATE AXIS SYSTEM DEFINITIONS

4.1 Aerodynamic Coefficients

The static aerodynamic coefficients of the store model are measured and calculated in a body-axis system of coordinates (see Section 4.4). The body-axis directions are parallel to the calibrated balance normal-force, side-force, and axial-force directions, but the moment reference point may be arbitrarily selected. For trajectory data, the moment reference point is occasionally shifted from the store cg. to compensate for model scaling effects on the static stability (see Fig. 1).

4.2 Trajectory Calculations

The trajectory calculations are carried out in the inertial-axis system as defined in Section 4.4. Even though the store-model moment reference point may be shifted, as mentioned in the previous section, the trajectory calculations consider the motion with respect to the true cg. Following the determination of the store positions and attitudes in the inertial-axis system, corresponding values of the positions and attitudes in the other axis systems are calculated (see Section 4.4). The relationship among the inertial, store body, and aircraft flight axis systems are shown in Fig. 5. Graphical representations of the yaw-pitch-roll and pitch-yaw-roll methods of designating store angular orientation, as defined with the various axis systems, are shown in Figs. 6 and 7.

4.3 Grid Positioning

Positioning of the store model during grid testing is carried out in the reference-axis system (see Section 4.5). Following determination of the store position in the reference-axis system, corresponding values of the positions and attitudes in other axis systems are calculated (see Section 4.5).

4.4 Trajectory Coordinate Axis System Definitions

STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_B	Parallel to the store longitudinal axis, positive direction is upstream at store release
Y_B	Perpendicular to X_B and Z_B directions, positive to the right looking upstream when the store is at zero yaw and roll angles
Z_B	Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Origin

The store body-axis system origin is coincident with the store cg at all time. The X_B, Y_B, and Z_B coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

INERTIAL-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_I — Parallel to the aircraft flight path direction at store release, positive forward as seen by the pilot

Y_I — Perpendicular to the X_I and Z_I directions, positive to the right as seen by the pilot

Z_I — Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction at store release, positive downward as seen by the pilot

Origin

The inertial-axis system origin is coincident with the store cg at release and translates along the initial aircraft flight path direction at the free-stream velocity. The coordinate axes do not rotate with respect to the initial aircraft flight path direction.

Positions

X_I — Separation distance of the store cg from the inertial-axis system origin in the X_I direction, ft, full scale

Y_I — Separation distance of the store cg from the inertial-axis system origin in the Y_I direction, ft, full scale

Z_I — Separation distance of the store cg from the inertial-axis system origin in the Z_I direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

ψ_I — Angle between the projection of the store longitudinal axis in the X_I-Y_I plane and the X_I-axis, positive for store nose to the right as seen by the pilot, deg

θ_I — Angle between the store longitudinal axis and its projection in the X_I-Y_I plane, positive when store nose is raised as seen by the pilot, deg

ϕ_I — Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_I-Y_I planes, positive for clockwise rotation when looking upstream, deg

NON-ROTATING FLIGHT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_I	Parallel to the aircraft flight path direction at store release, positive forward as seen by the pilot
Y_I	Perpendicular to the X_I and Z_I directions, positive to the right as seen by the pilot
Z_I	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction at store release, positive downward as seen by the pilot

Origin

The flight-axis system origin is coincident with the store cg at release. The origin is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes do not rotate with respect to the initial aircraft flight path direction.

Positions

X_C	Separation distance of the store cg from the flight-axis system origin in the X_I direction, ft, full scale
Y_C	Separation distance of the store cg from the flight-axis system origin in the Y_I direction, ft, full scale
Z_C	Separation distance of the store cg from the flight-axis system origin in the Z_I direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

ψ_I	Angle between the projection of the store longitudinal axis in the X_I-Y_I plane and the X_I-axis, positive for the store nose to the right as seen by the pilot, deg
θ_I	Angle between the store longitudinal axis and its projection in the X_I-Y_I plane, positive when the store nose is raised as seen by the pilot, deg
ϕ_I	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_I-Y_I planes, positive clockwise rotation when looking upstream, deg

NON-ROTATING FLIGHT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_I — Parallel to the aircraft flight path direction at store release, positive forward as seen by the pilot

Y_I — Perpendicular to the X_I and Z_I directions, positive to the right as seen by the pilot

Z_I — Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction at store release, positive downward as seen by the pilot

Origin

The flight-axis system origin is coincident with the store cg at release. The origin is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes do not rotate with respect to the initial aircraft flight path direction.

Positions

X_C — Separation distance of the store cg from the flight-axis system origin in the X_I direction, ft, full scale

Y_C — Separation distance of the store cg from the flight-axis system origin in the Y_I direction, ft, full scale

Z_C — Separation distance of the store cg from the flight-axis system origin in the Z_I direction, ft, full scale

Attitudes (Pitch, Yaw, Roll Sequence)

ν_I — Angle between the projection of the store longitudinal axis in the X_I-Z_I plane and the X_I-axis, positive when the store nose is raised as seen by the pilot, deg

η_I — Angle between the store longitudinal axis and its projection in the X_I-Z_I plane, positive when the store nose is to the right as seen by the pilot, deg

ω_I — Angle between the store vertical (Z_B) axis and the intersection of the Y_B-Z_B and X_I-Z_I planes, positive for clockwise rotation when looking upstream, deg

FLIGHT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_F	Parallel to the current aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the current aircraft flight path direction, positive downward as seen by the pilot

Origin

The flight-axis system origin is coincident with the store cg at release. The origin is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes rotate to maintain alignment of the X_F-axis with the current aircraft flight path direction.

Positions

X	Separation distance of the store cg from the flight-axis system origin in the X_F direction, ft, full scale
Y	Separation distance of the store cg from the flight-axis system origin in the Y_F direction, ft, full scale
Z	Separation distance of the store cg from the flight-axis system origin in the Z_F direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

ψ	Angle between the projection of the store longitudinal axis in the X_F-Y_F plane and the X_F-axis, positive when the store nose is to the right as seen by the pilot, deg
θ	Angle between the store longitudinal axis and its projection in the X_F-Y_F plane, positive when the store nose is raised as seen by the pilot, deg
ϕ	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_F-Y_F planes, positive for clockwise rotation when looking upstream, deg

NON-ROTATING PYLON-AXIS SYSTEM DEFINITIONS

Coordinate Directions

$X_{P,C}$ — Parallel to the store longitudinal axis at release, positive direction is forward as seen by the pilot

$Y_{P,C}$ — Perpendicular to the $X_{P,C}$ direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot

$Z_{P,C}$ — Perpendicular to the $X_{P,C}$ and $Y_{P,C}$ directions, positive downward as seen by the pilot

Origin

The pylon-axis system origin is coincident with the flight-axis system origin and the store cg at release. It is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes do not rotate with respect to the initial aircraft flight path direction.

Positions

$X_{P,C}$ — Separation distance of the store cg from the flight-axis system origin in the $X_{P,C}$ direction, ft, full scale

$Y_{P,C}$ — Separation distance of the store cg from the flight-axis system origin in the $Y_{P,C}$ direction, ft, full scale

$Z_{P,C}$ — Separation distance of the store cg from the flight-axis system origin in the $Z_{P,C}$ direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

$\Delta\psi_C$ — Angle between the projection of the store longitudinal axis in the $X_{P,C}$ - $Y_{P,C}$ plane and the $X_{P,C}$ - axis positive for store nose to the right as seen by the pilot, deg

$\Delta\theta_C$ — Angle between the store longitudinal axis and its projection in the $X_{P,C}$ - $Y_{P,C}$ plane, positive when the store nose is raised as seen by the pilot, deg

$\Delta\phi_C$ — Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and $X_{P,C}$ - $Y_{P,C}$ planes, positive for clockwise rotation when looking upstream, deg

NON-ROTATING PYLON-AXIS SYSTEM DEFINITIONS

Coordinate Directions

$X_{P,C}$ — Parallel to the store longitudinal axis at release, positive direction is forward as seen by the pilot

$Y_{P,C}$ — Perpendicular to the $X_{P,C}$ direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot

$Z_{P,C}$ — Perpendicular to the $X_{P,C}$ and $Y_{P,C}$ directions, positive downward as seen by the pilot

Origin

The pylon-axis system origin is coincident with the flight-axis system origin and the store cg at release. It is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes do not rotate with respect to the initial aircraft flight path direction.

Positions

$X_{P,C}$ — Separation distance of the store cg from the flight-axis system origin in the $X_{P,C}$ direction, ft, full scale

$Y_{P,C}$ — Separation distance of the store cg from the flight-axis system origin in the $Y_{P,C}$ direction, ft, full scale

$Z_{P,C}$ — Separation distance of the store cg from the flight-axis system origin in the $Z_{P,C}$ direction, ft, full scale

Attitudes (Pitch, Yaw, Roll Sequence)

$\Delta\nu_C$ — Angle between the projection of the store longitudinal axis in the $X_{P,C}$ - $Z_{P,C}$ plane and the $X_{P,C}$ - axis, positive when the store nose is raised as seen by the pilot, deg

$\Delta\eta_C$ — Angle between the store longitudinal axis and its projection in the $X_{P,C}$ - $Z_{P,C}$ plane, positive when the store nose is to the right as seen by the pilot, deg

$\Delta\omega_C$ — Angle between the store vertical (Z_B) axis and the intersection of the Y_B-Z_B and $X_{P,C}$ - $Z_{P,C}$ planes, positive for clockwise rotation when looking upstream, deg

PYLON-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_P — Parallel to the store longitudinal axis at release and at constant angular orientation with respect to the current aircraft flight path direction, positive forward as seen by the pilot

Y_P — Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot

Z_P — Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

Origin

The pylon-axis system origin is coincident with the flight-axis system origin and the store cg at release. It is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes rotate to maintain constant angular orientation with respect to the current aircraft flight path direction.

Positions

X_P — Separation distance of the store cg with respect to the flight-axis system origin in the X_P direction, ft, full scale

Y_P — Separation distance of the store cg with respect to the flight-axis system origin in the Y_P direction, ft, full scale

Z_P — Separation distance of the store cg with respect to the flight-axis system origin in the Z_P direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

$\Delta\psi$ — Angle between the projection of the store longitudinal axis in the X_P-Y_P plane and the X_P-axis, positive for store nose to the right as seen by the pilot, deg

$\Delta\theta$ — Angle between the store longitudinal axis and its projection in the X_P-Y_P plane, positive when the store nose is raised as seen by the pilot, deg

$\Delta\phi$ — Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_P-Y_P planes, positive for clockwise rotation when looking upstream, deg

PYLON-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_P Parallel to the store longitudinal axis at release and at constant angular orientation with respect to the current aircraft flight path direction, positive forward as seen by the pilot

Y_P Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot

Z_P Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

Origin

The pylon-axis system origin is coincident with the flight-axis system origin and the store cg at release. It is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes rotate to maintain constant angular orientation with respect to the current aircraft flight path direction.

Positions

X_P Separation distance of the store cg with respect to the flight-axis system origin in the X_P direction, ft, full scale

Y_P Separation distance of the store cg with respect to the flight-axis system origin in the Y_P direction, ft, full scale

Z_P Separation distance of the store cg with respect to the flight-axis system origin in the Z_P direction, ft, full scale

Attitudes (Pitch, Yaw, Roll Sequence)

$\Delta\nu$ Angle between the projection of the store longitudinal axis in the X_P-Z_P plane and the X_P-axis, positive when the store nose is raised as seen by the pilot, deg

$\Delta\eta$ Angle between the store longitudinal axis and its projection in the X_P-Z_P plane, positive when the store nose is to the right as seen by the pilot, deg

$\Delta\omega$ Angle between the store vertical (Z_B) axis and the intersection of the Y_B-Z_B and X_P-Z_P planes, positive for clockwise rotation when looking upstream, deg

AIRCRAFT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_A	Parallel to the aircraft longitudinal axis at store release and at constant angular orientation with respect to the current aircraft flight path direction, positive forward as seen by the pilot
Y_A	Perpendicular to the X_A direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot
Z_A	Perpendicular to the X_A and Y_A directions, positive downward as seen by the pilot

Origin

The aircraft-axis system origin is coincident with the flight-axis system origin and the store cg at release. It is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes rotate to maintain constant angular orientation with respect to the current aircraft flight path direction.

Positions

X_A	Separation distance of the store cg with respect to the flight-axis system origin in the X_A direction, ft, full scale
Y_A	Separation distance of the store cg with respect to the flight-axis system origin in the Y_A direction, ft, full scale
Z_A	Separation distance of the store cg with respect to the flight-axis system origin in the Z_A direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

$\Delta\psi_A$	Angle between the projection of the store longitudinal axis in the X_A-Y_A plane and the X_A-axis, positive for store nose to the right as seen by the pilot, deg
$\Delta\theta_A$	Angle between the store longitudinal axis and its projection in the X_A-Y_A plane, positive when the store nose is raised as seen by the pilot, deg
$\Delta\phi_A$	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_A-Y_A planes, positive for clockwise rotation when looking upstream, deg

EARTH-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_E	Parallel to a projection of the X_I axis on the earth surface, positive direction is forward as seen by the pilot
Y_E	Perpendicular to the X_E and Z_E directions, positive to the right as seen by the pilot
Z_E	Perpendicular to the earth surface, positive direction is down

Origin

The earth-axis system origin is fixed at the point in space coincident to the store cg at release.

Positions

X_E	Separation distance of the store cg from the earth-axis system origin in the X_E direction, ft, full scale
Y_E	Separation distance of the store cg from the earth-axis system origin in the Y_E direction, ft, full scale
Z_E	Separation distance of the store cg from the earth-axis system origin in the Z_E direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

ψ_E	Angle between the projection of the store longitudinal axis in the X_E-Y_E plane and X_E-axis, positive for store nose to the right as seen by the pilot, deg
θ_E	Angle between the store longitudinal axis and its projection in the X_E-Y_E plane, positive when the store nose is raised as seen by the pilot, deg
ϕ_E	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_E-Y_E planes, positive for clockwise rotation when looking upstream, deg

4.5 Grid Coordinate Axis System Definitions

REFERENCE-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_{REF}	Parallel to the __________ direction, positive forward as seen by the pilot
Y_{REF}	Perpendicular to the X_{REF} direction and rotated through an angle ϕ_{REF} with respect to the __________ direction, positive to the right as seen by the pilot for zero rotation angle
Z_{REF}	Perpendicular to the X_{REF} and Y_{REF} directions, positive downward as seen by the pilot for zero rotation of the Y_{REF} axis

Origin

The REFERENCE-AXIS system origin may be arbitrarily chosen and is determined from the set of initial position coordinates input at the initialization of the grid set. It is fixed with respect to the aircraft for the duration of the grid set. For this test, origin coordinates and ϕ_{REF} angles are defined as follows:

Positions

X_{REF}	Position of the store cg with respect to the reference-axis system origin in the X_{REF} direction, ft, full scale
Y_{REF}	Position of the store cg with respect to the reference-axis system origin in the Y_{REF} direction, ft, full scale
Z_{REF}	Position of the store cg with respect to the reference-axis system origin in the Z_{REF} direction, ft, full scale

STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_B — Parallel to the store longitudinal axis, positive direction is upstream at store release

Y_B — Perpendicular to X_B and Z_B directions, positive to the right looking upstream when the store is at zero yaw and roll angles

Z_B — Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Origin

The store body-axis system origin is coincident with the store cg at all time. The X_B, Y_B, and Z_B coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

PYLON-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_P Parallel to the store longitudinal axis at carriage, positive forward as seen by the pilot

Y_P Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot

Z_P Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

Origin

The pylon-axis system origin is coincident with the reference-axis system origin.

Positions

X_P Position of the store cg with respect to the pylon-axis system origin in the * X_P direction, ft, full scale

Y_P Position of the store cg with respect to the pylon-axis system origin in the * Y_P direction, ft, full scale

Z_P Position of the store cg with respect to the pylon-axis system origin in the * Z_P direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

$\Delta\psi$ Angle between the projection of the store longitudinal axis in the X_P-Y_P plane and the X_P-axis, positive for store nose to the right as seen by the pilot, deg

$\Delta\theta$ Angle between the store longitudinal axis and its projection in the X_P-Y_P plane, positive when the store nose is raised as seen by the pilot, deg

$\Delta\phi$ Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_P-Y_P planes, positive for clockwise rotation when looking upstream, deg

* Positive or negative as required

AIRCRAFT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_A	Parallel to the aircraft longitudinal axis, positive forward as seen by the pilot
Y_A	Perpendicular to the aircraft plane of symmetry, positive to the right as seen by the pilot
Z_A	Perpendicular to the X_A and Y_A directions, positive downward as seen by the pilot

Origin

The aircraft-axis system origin is coincident with the reference-axis system origin.

Positions

X_A	Position of the store cg with respect to the aircraft-axis system origin in the * X_A direction, ft, full scale
Y_A	Position of the store cg with respect to the aircraft-axis system origin in the * Y_A direction, ft, full scale
Z_A	Position of the store cg with respect to the aircraft-axis system origin in the * Z_A direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

$\Delta\psi_A$	Angle between the projection of the store longitudinal axis in the X_A-Y_A plane and the X_A-axis, positive for store nose to the right as seen by the pilot, deg
$\Delta\theta_A$	Angle between the store longitudinal axis and its projection in the X_A-Y_A plane, positive when the store nose is raised as seen by the pilot, deg
$\Delta\phi_A$	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_A-Y_A planes, positive for clockwise rotation when looking upstream, deg

* Positive or negative as required

FLIGHT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_F	Parallel to the aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The flight-axis system origin is coincident with the reference-axis system origin.

Positions

X	Position of the store cg with respect to the flight-axis system origin in the * X_F direction, ft, full scale
Y	Position of the store cg with respect to the flight-axis system origin in the * Y_F direction, ft, full scale
Z	Position of the store cg with respect to the flight-axis system origin in the * Z_F direction, ft, full scale

Attitudes (Yaw, Pitch, Roll Sequence)

ψ	Angle between the projection of the store longitudinal axis in the X_F-Y_F plane and the X_F-axis, positive when the store nose is to the right as seen by the pilot, deg
θ	Angle between the store longitudinal axis and its projection in the X_F-Y_F plane, positive when the store nose is raised as seen by the pilot, deg
ϕ	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_p-Y_p planes, positive for clockwise rotation when looking upstream, deg

* Positive or negative as required

SECTION V

PARAMETERS AVAILABLE FOR OUTPUT

5.1 Standard Trajectory Tabulation

The standard data output tabulation used on all captive trajectory tests consists of flight-axis positions, velocities, and accelerations, the store model measured static aerodynamic coefficients in body-axis coordinates, the store model angle of attack and sideslip angle, the simulated flight dynamic pressure, and the ejector forces. This tabulation requires two pages of computer printout, and a sample of the format produced is shown in Table 1. The three lines of header information on each page are standard. A nomenclature for the tabulated data is given in Table 2.

5.2 Standard Grid Tabulation

The standard data output tabulation used on all grid tests consists of reference-axis positions, pylon-axis attitudes, store model angle of attack and sideslip angle, store model measured static aerodynamic coefficients in the body-axis coordinates, and tunnel dynamic pressure. This tabulation requires one page of computer printout and a sample of the format produced is shown in Table 3. The two lines of header information are standard. A nomenclature for the tabulated data is given in Table 4.

5.3 Optional Trajectory Tabulation

Additional pages containing other parameters may be obtained by request on a test-to-test basis. A typical example is given in Table 1. A fourth header line may be added, if necessary, by request for each test. Any requirements beyond the standard presentation, especially data needed for on-line review during testing, must be specified well in advance of the test date to assure that the proper formats may be obtained.

In addition to the store position data (Section 4.4) and aerodynamic data (Section 5.5), a number of other trajectory parameters are available in the data base for presentation. These quantities are listed (along with standard output parameters) as follows:

q_A	Simulated full-scale dynamic pressure, psf
q_p	Simulated pitch rate of the aircraft during accelerated fight, deg/sec
θ_p	Angle between the X_I and X_F axes, positive if N_Z greater than 1, deg
F_X, F_Y, F_Z	Total forces acting on the full-scale store in the positive X_B, Y_B, and Z_B directions, respectively, lb

M_X, M_Y, M_Z	Total rolling moment, pitching moment and yawing moment acting on the full-scale store. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively, ft-lb
p, q, r	Angular velocities of the full-scale store about the X_B, Y_B, and Z_B axes. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively
$\dot{p}, \dot{q}, \dot{r}$	Angular accelerations of the full-scale store about the X_B, Y_B, and Z_B axes. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively, rad/sec^2
u, v, w	Velocities of the full-scale store relative to the origin of the inertial axis system in the positive X_B, Y_B, and Z_B directions, respectively, ft/sec
$\dot{u}, \dot{v}, \dot{w}$	Acceleration of the full-scale store relative to the origin of the inertial axis system in the positive X_B, Y_B, and Z_B directions, respectively, ft/sec
V_X, V_Y, V_Z	Velocity components of the full-scale store relative to the origin of a space-fixed axis system in the positive X_B, Y_B, and Z_B directions, respectively, ft/sec
R_ℓ, R_m, R_n	Full-scale body-axis pivot (rotation center) restraining moments. The positive vectors are coincident with the positive X_B, Y_B, and Z_B directions, respectively, ft-lb
$R_{P,\ell}, R_{P,m}, R_{P,n}$	Full-scale pylon-axis pivot (rotation center) restraining moments. The positive vectors are coincident with the positive X_P, Y_P, and Z_P directions, respectively, ft-lb
$R_{P,X}, R_{P,Y}, R_{P,Z}$	Full-scale pylon-axis pivot (rotation center) restraining forces, positive in the positive X_P, Y_P, and Z_P directions, lb
R_X, R_Y, R_Z	Full-scale body-axis pivot (rotation center) restraining forces, positive in the positive X_B, Y_B, and Z_B directions, lb

<u>NOSE, TAIL, HOOK COORDINATE PARAMETERS</u>

$X_{F,i}, Y_{F,i}, Z_{F,i}$	Location of the store nose (i = N) or tail (i = T) in the flight-axis system X_F, Y_F, and Z_F directions; ft, full scale measured from the carriage position of the store cg
$X_{P,i}, Y_{P,i}, Z_{P,i}$	Location of the store nose (i = N) or tail (i = T) in the pylon-axis system X_P, Y_P, and Z_P directions; ft, full scale measured from the carriage position of the store cg

$X_{P,H}, Y_{P,H}, Z_{P,H}$	Location of the store hook in the pylon-axis system X_P, Y_P, and Z_P directions; ft, full scale measured from the carriage position of the hook

5.4 Optional Grid Tabulation

Additional pages containing other parameters (see Sections 4.5 and 5.5) may be obtained by request on a test-to-test basis. A typical example is given in Table 3. A third header line may be added, if necessary, by request for each test. Any requirements beyond the standard presentation, especially data needed for on-line review during testing, must be specified well in advance of the test date to assure that the proper formats may be obtained.

5.5 Aerodynamic Coefficient Data for Different Axis Systems

Aerodynamic coefficient data available for tabulation with either the trajectory or grid programs is listed as follows:

α_S, β_S	Store model angle of attack and sideslip angle, respectively, deg
$C_{A,t}, C_N, C_Y$	Store measured aerodynamic axial-force, normal-force and side-force coefficients, positive in the negative X_B, negative Z_B and positive Y_B directions, respectively
C_ℓ, C_m, C_n	Store measured aerodynamic rolling-moment, pitching-moment and yawing-moment coefficients. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively
$C_{DW,t}, C_{LW}, C_{CW}$	Wind axis drag, lift, and cross-wind coefficients, positive in the wind axis negative X_W, negative Z_W, and positive Y_W directions, respectively
$C_{\ell W}, C_{mW}, C_{nW}$	Wind-axis rolling-moment, pitching-moment, and yawing moment coefficients. The positive vectors are coincident with the wind axis positive X_W, Y_W, and Z_W directions, respectively
$\alpha_{a,s}$	Store model total (aeroballistic) angle of attack, angle between the body X_B-axis and the free-stream wind X-axis, always positive, deg
$\phi_{a,s}$	Aerodynamic roll angle, angle between the aeroballistic Y_A-axis and the body Y_B-axis, positive clockwise looking upstream, deg
$C_{Aa,t}, C_{Na}, C_{Ya}$	Aeroballistic axis axial-force, normal-force and side-force coefficients, positive in the aeroballistic axis negative X_A, negative Z_A, and positive Y_A directions, respectively

$C_{\ell a}, C_{ma}, C_{na}$ — Aeroballistic axis rolling-moment, pitching-moment and yawing-moment coefficients. The positive vectors are coincident with the aeroballistic axis positive X_A, Y_A, and Z_A directions, respectively

$C_{Ds,t}, C_{Ls}, C_{Ys}$ — Stability axis axial-force, normal-force and side-force coefficients, positive in the stability axis negative X_S, negative Z_S, and positive Y_S directions, respectively

$C_{\ell s}, C_{ms}, C_{ns}$ — Stability axis rolling-moment, pitching-moment, and yawing-moment coefficients. The positive vectors are coincident with the stability axis positive X_S, Y_S, and Z_S directions, respectively

Rotated Body-Axis Parameters

ϕ_{RB} — Roll angle of the rotated body axis negative Z_B direction with respect to the balance $+C_N$ direction, positive for clockwise rotation when looking upstream, deg

For trajectory or grid calculations, the body axis negative Z_B direction is required to remain coincident with the balance $+C_N$ vector. If this is not the final body-axis orientation desired, the body axis parameters (coefficients, accelerations, velocities, etc.) may be defined at a new roll orientation by resolution through the angle ϕ_{RB}. The parameters at the new roll orientation are denoted by the subscripts RB (i.e., $C_{N,RB}$, ν_{RB}, etc.).

Body-Axis Interference Coefficients

$\Delta C_{A,t}, \Delta C_N, \Delta C_Y$ — Store calculated aerodynamic axial-force, normal-force, and side-force flow-field influence coefficients, difference in measured coefficient values in the aircraft flow field and the free stream at comparable attitude, positive in the negative X_B, negative Z_B and positive Y_B directions, respectively

$\Delta C_\ell, \Delta C_m, \Delta C_n$ — Store calculated aerodynamic rolling-moment, pitching-moment and yawing-moment flow-field influence coefficients, difference in measured coefficient values in the aircraft flow field and the free stream at comparable attitude. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively

Store interference coefficients may be calculated if data are obtained at comparable test conditions (Mach number and store pitch/yaw/roll combinations) in both the aircraft flow field and the free stream. For grid applications, interference data are routinely calculated because the number of store attitude combinations is small, and a single interpolation scheme can be used.

For trajectory applications (where the number of store attitude combinations is normally large), a double interpolation scheme is applied to the free-stream data which requires free-stream pitch sweeps at five different sideslip angles. If interference coefficient data are desired, plan the free-stream attitude range to be sufficiently large to encompass all anticipated attitudes in the flow field. The curve fitting routine currently used works well when the free-stream data can be interpolated, but is suspect if the free-stream data must be extrapolated.

5.6 Magnetic Tapes

For both trajectory and grid programs, any of the parameters available for output on the tabulated data are also available for output on magnetic tape. Typical examples of information supplied with (and required to create) the magnetic tape data are shown in Tables 5 and 6. All tapes are created by the Amdahl 5860 central computer.

5.7 Real Time Plotting

On-line data plotting is produced on a real time basis for data monitoring. The plots are displayed on a CRT in the control room. Generally displayed for the trajectory program are CTS positions and orientations, aerodynamic coefficients, and CTS position errors versus time. Generally displayed for the grid program are aerodynamic coefficients and CTS position errors versus position (or orientation). No capability for comparison plotting or hard copies is available with this system.

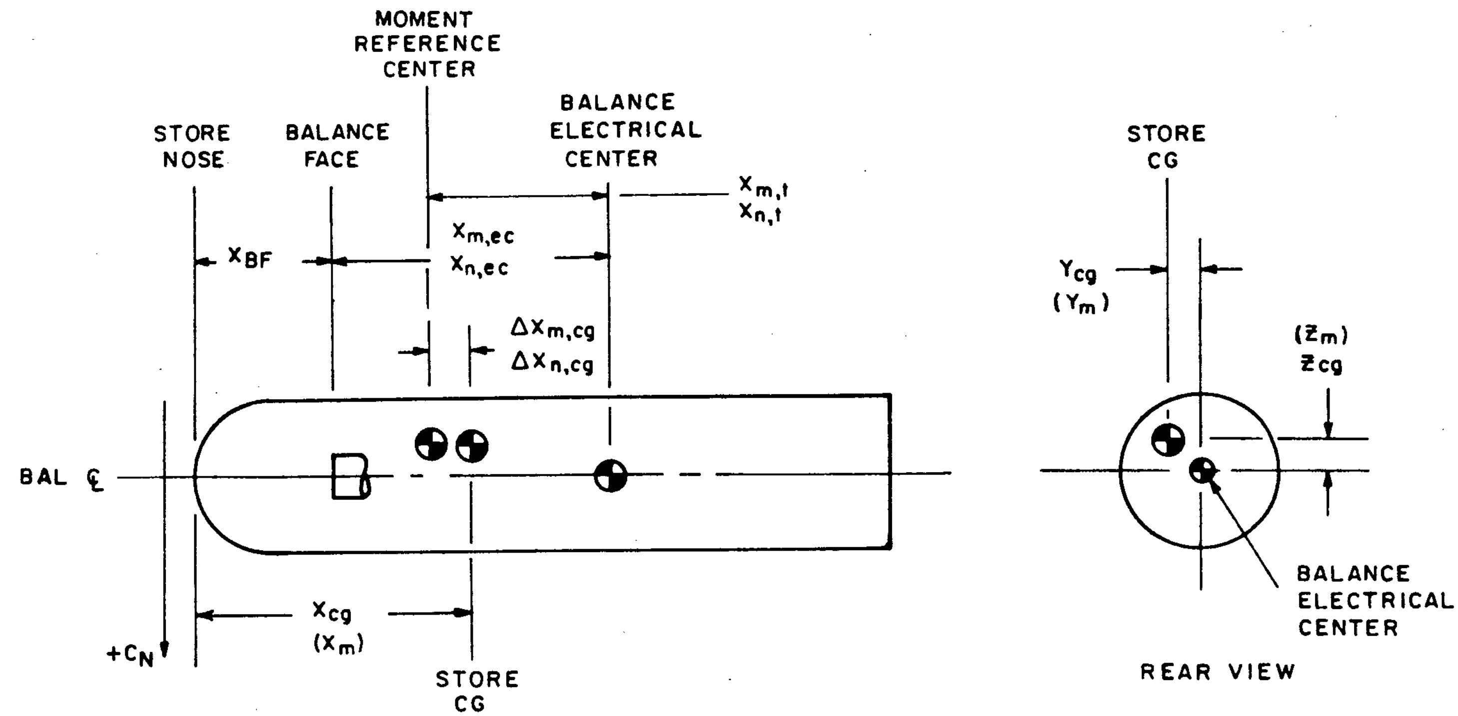
5.8 Central Computer Graphics System

For both trajectory and grid programs, any of the parameters available for output on the tabulated data are also available for plotting on the central computer graphics system. Plotting with this system can be done on a near real time basis and capability exists for comparison plots and for hard copies. There are no standard plot formats that are always produced, and plotting requests should be defined in advance for each test. Typical examples of hard copy plots available from the graphics system are shown in Fig. 8.

SECTION VI

SIMULATION OF STORE GUIDANCE AND CONTROL SYSTEMS FOR TRAJECTORY APPLICATIONS

The simulation of store trajectories with active guidance and control systems requires a mathematical model of the inertial and/or mechanical response of the systems. Since the mechanisms are unique to each store, no standard programming exists to describe them. However, the standard trajectory program is capable of dealing with the active control situation by calculating incremental aerodynamic coefficients resulting from the control surface deflections. Information required by PWT includes a mathematical algorithm describing the control surface movements as functions of store acceleration, velocity, position, attitude, etc., and the body-axis aerodynamic coefficient variations resulting from the control surface deflections. Since this requires test unique program additions, at least 8 weeks time should be allowed to permit program preparation and checkout. Sample check calculations should be provided, if available.



NOTE : $\Delta X_{m,cg}$, $\Delta X_{n,cg}$ ARE USED TO TRANSFER THE C_m AND C_n MOMENT REFERENCES FROM THE CG POSITION. HOWEVER, MOTION IS STILL CALCULATED ABOUT THE TRUE CG POSITION AND THE OFFSET COEFFICIENT DATA ARE USED AS THOUGH OBTAINED ABOUT THE TRUE CG POSITION.

Figure 1. Store/balance physical definition.

THRUST	CONTROL PARAMETER
0	NO THRUST FORCES
1	NO DELAY (TIME OR LANYARD LENGTH)
2	TIME DELAY ONLY
3	LANYARD DELAY, THEN TIME DELAY

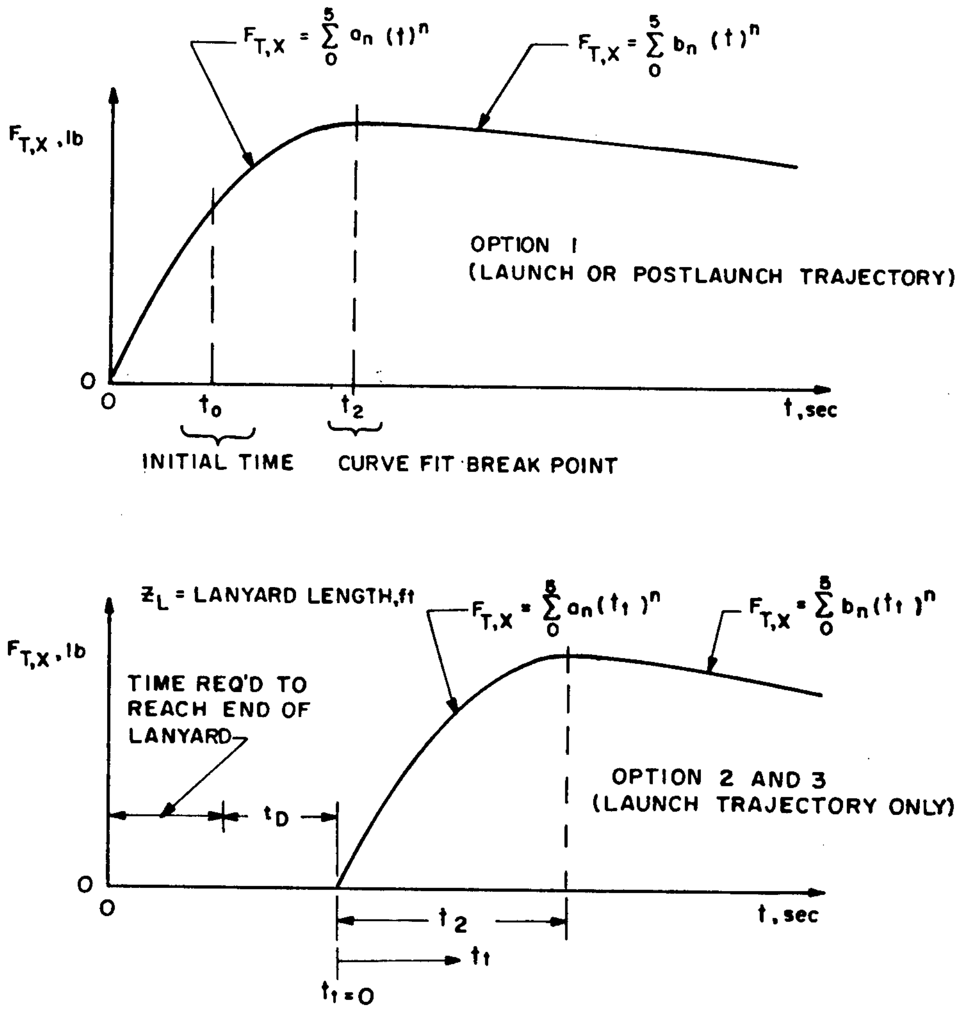


Figure 2. Graphic description of thrust force.

EJECT	CONTROL PARAMETER
0	NO EJECTOR FORCES
1	EJECTOR FORCES & CUTOFF = f(TIME)
2	EJECTOR FORCES & CUTOFF = f(STROKE)
3	EJECTOR FORCES = f(TIME), CUTOFF = f(STROKE)

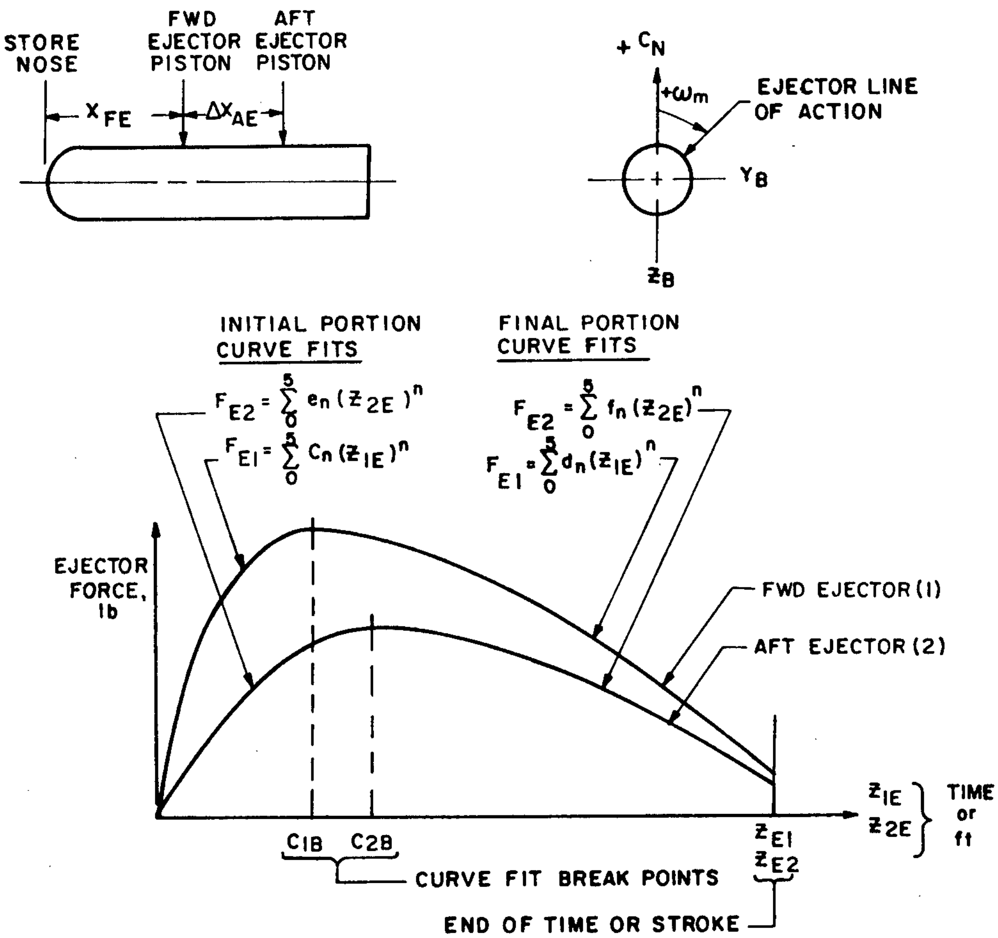


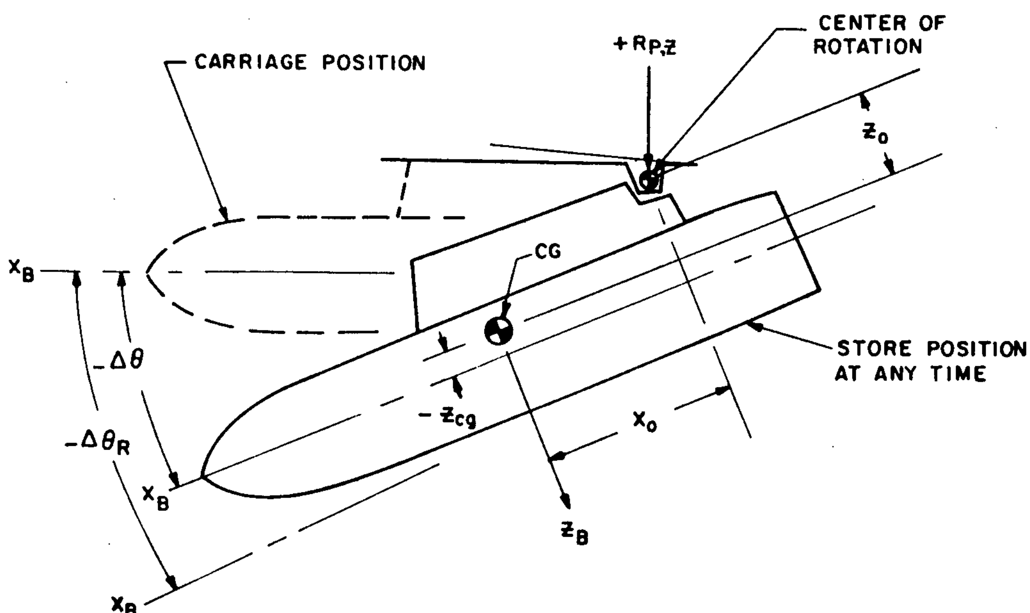
Figure 3. Graphic description of ejector forces.

CONTROL PARAMETER IS MOTION

MOTION	TYPE MOTION	INITIAL RELEASE CRITERION	FINAL RELEASE CRITERION
0	UNRESTRICTED	—	—
1	PIVOT; PITCH ONLY	$\Delta\theta_R$	$R_{P,z}$
2	PIVOT; PITCH AND YAW	$\Delta\theta_R$	$R_{P,z}$
3	PIVOT; PITCH, YAW, ROLL	$\Delta\theta_R$	$R_{P,z}$
4	RAIL; TRANSLATE ONLY	$x_{P,1}$	$x_{P,1}$
5	RAIL; TRANSLATE AND PITCH	$x_{P,1}$	$x_{P,2}$
6	RAIL; TRANSLATE AND YAW	$x_{P,1}$	$x_{P,2}$
7	RAIL; TRANSLATE, PITCH AND YAW	$x_{P,1}$	$x_{P,2}$
8	TRANSLATE, ROTATE IN EJECTOR PLANE	EJECT	EJECT

PIVOT MOTION (OPTIONS 1,2,3)

RESTRICTION: $Y_0 \equiv 0$



RELEASE CRITERIA

INITIAL IF $(\Delta\theta - \Delta\theta_R) < 0$, CHECK $R_{P,z}$

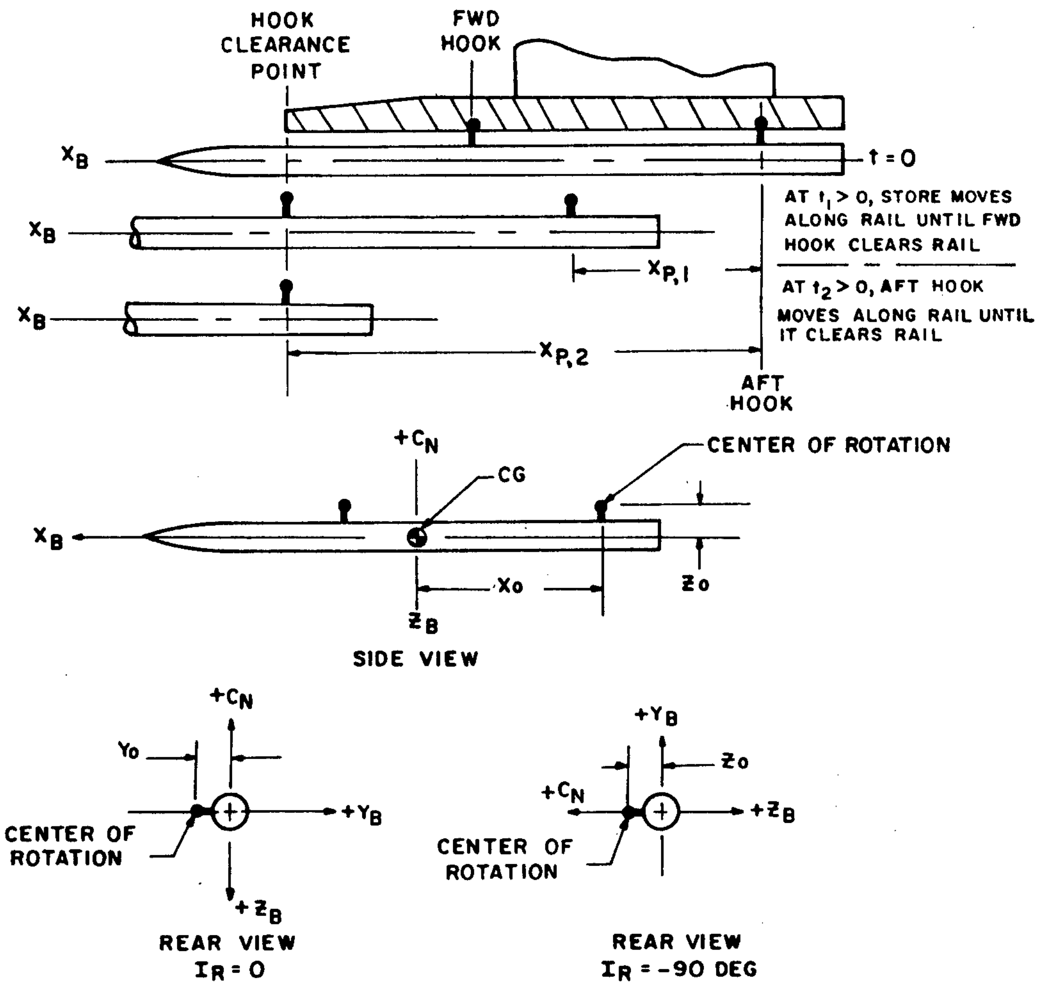
FINAL IF $R_{P,z} \le 0$, GO TO UNRESTRICTED MOTION

a. Pivot motion (options 1 through 3)

Figure 4. Graphic descriptions of staged release options.

RESTRICTIONS: 4 NONE
5 SIDE RAIL ONLY ($Z_o \equiv 0$)
6 BOTTOM RAIL ONLY ($Y_o \equiv 0$)
7 SIDE OR BOTTOM RAIL (Z_o OR Y_o MUST $\equiv 0$)

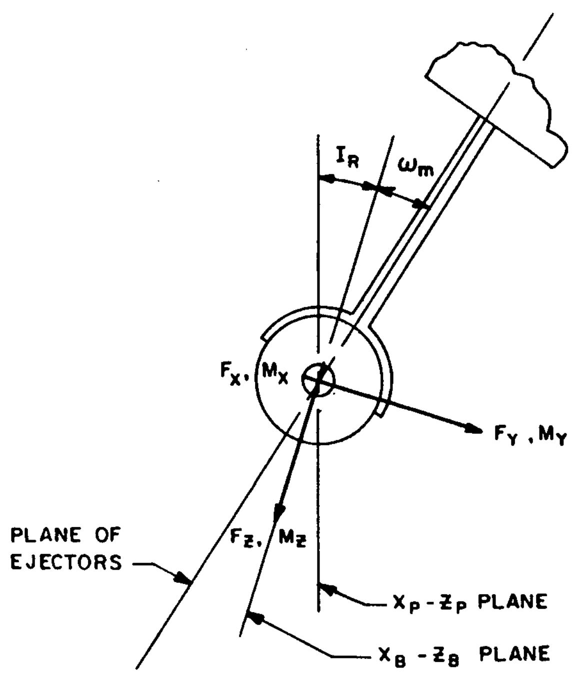
NOTES:
a) OPTIONS 4→7, TRANSLATE ONLY FOR AFT HOOK TRAVEL LESS THAN $X_{P,1}$
b) OPTIONS 5→7, ANGULAR MOTION (AS DESCRIBED) IN ADDITION TO TRANSLATION FOR AFT HOOK TRAVEL GREATER THAN $X_{P,1}$ BUT LESS THAN $X_{P,2}$
c) UNRESTRICTED MOTION FOR AFT HOOK TRAVEL GREATER THAN $X_{P,1}$ (OPTION 4), GREATER THAN $X_{P,2}$ (OPTIONS 5→7)



b. Rail motion (options 4 through 7)
Figure 4. Continued.

TRANSLATE, ROTATE ONLY IN PLANE OF EJECTORS (OPTION 8)

ASSUMPTION: MOTION ABOUT cg, NO INERTIA TRANSFER REQ'D
RESTRICTION: $I_{XY} = I_{XZ} = I_{YZ} \equiv 0$



STORE IS RESTRAINED TO TRANSLATION AND ROTATION IN THE PLANE OF THE EJECTORS DURING EJECTOR ACTION

RELEASE CRITERIA: IF EJECT = 0, GO TO UNRESTRAINED MOTION

c. Ejector plane motion
Figure 4. Concluded.

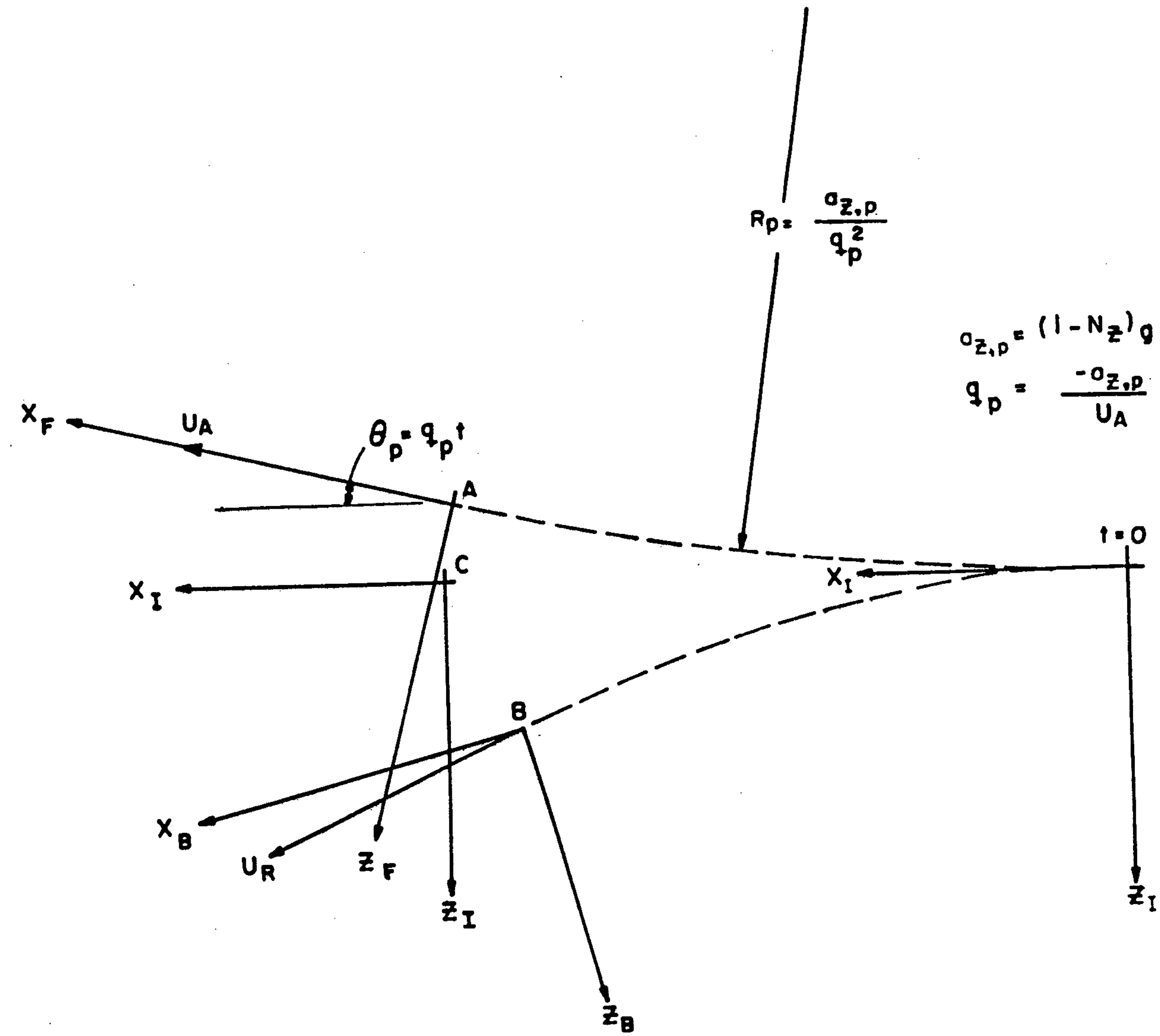
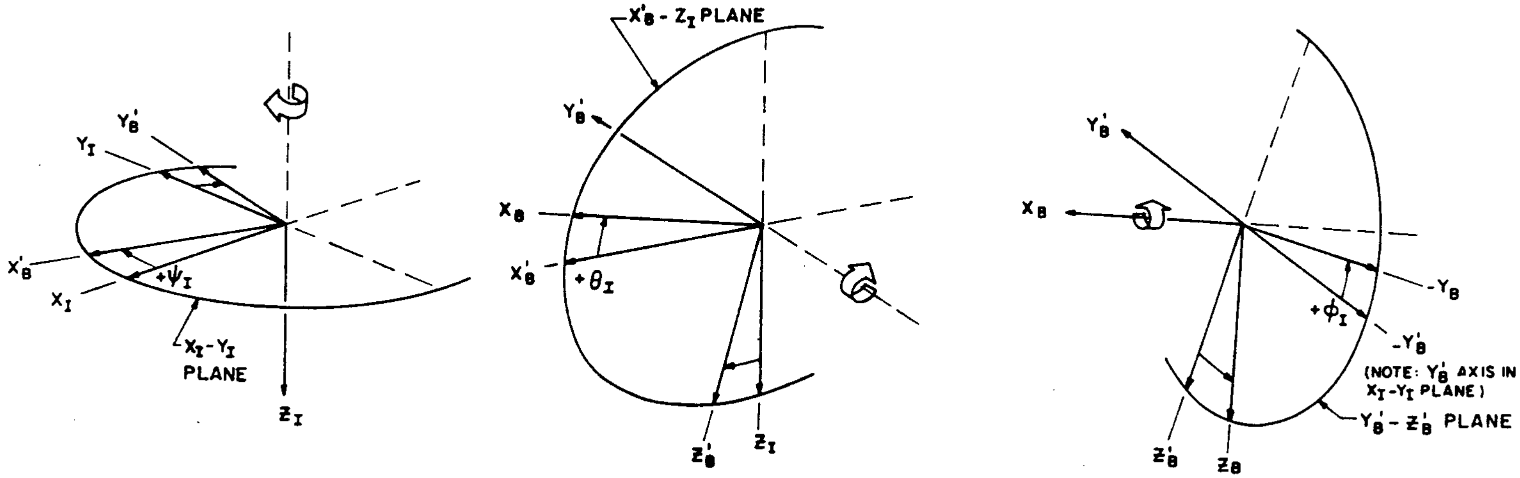


Figure 5. Body/inertial/flight-axes directions for an aircraft pullup/pushover maneuver.

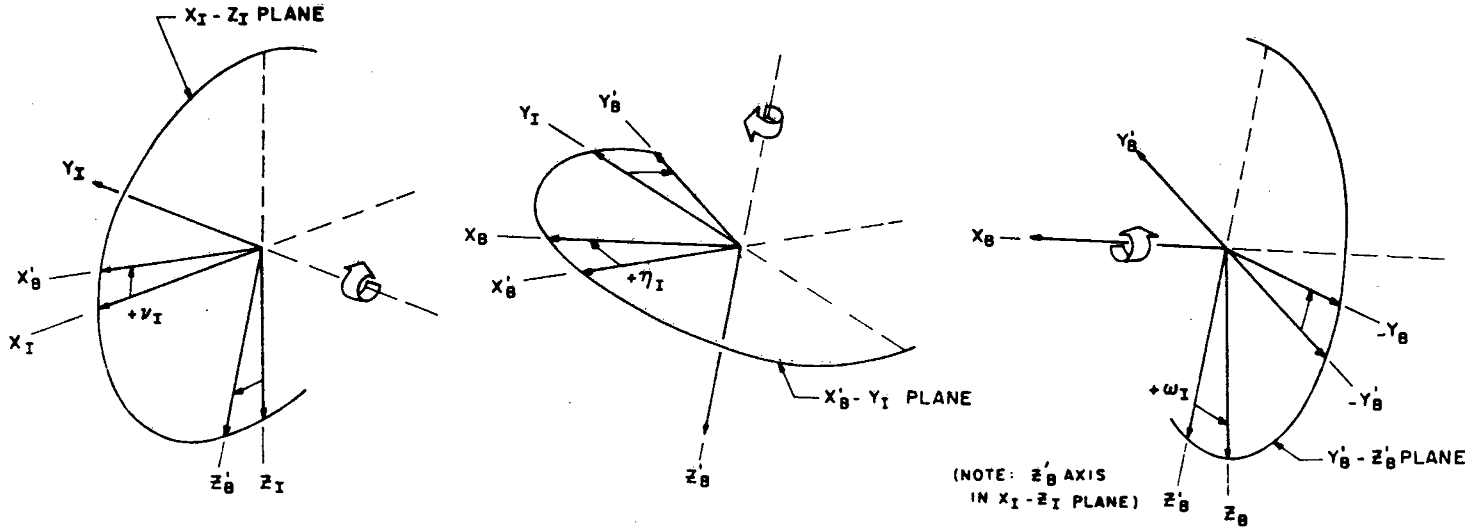


a) FIRST ROTATION, YAW ANGLE (ψ_I) (ROTATE ABOUT Z_I AXIS)

b) SECOND ROTATION, PITCH ANGLE (θ_I) (ROTATE ABOUT Y'_B AXIS)

c) THIRD ROTATION, ROLL ANGLE (ϕ_I) (ROTATE ABOUT X_B AXIS)

Figure 6. Graphic illustration of a yaw, pitch, roll (Euler) orientation sequence.



a) FIRST ROTATION, PITCH ANGLE(ν_I)
(ROTATE ABOUT Y_I AXIS)

b) SECOND ROTATION, YAW ANGLE (η_I)
(ROTATE ABOUT Z'_B AXIS)

c) THIRD ROTATION, ROLL ANGLE (ω_I)
(ROTATE ABOUT X_B AXIS)

Figure 7. Graphic illustration of a pitch, yaw, roll orientation sequence.

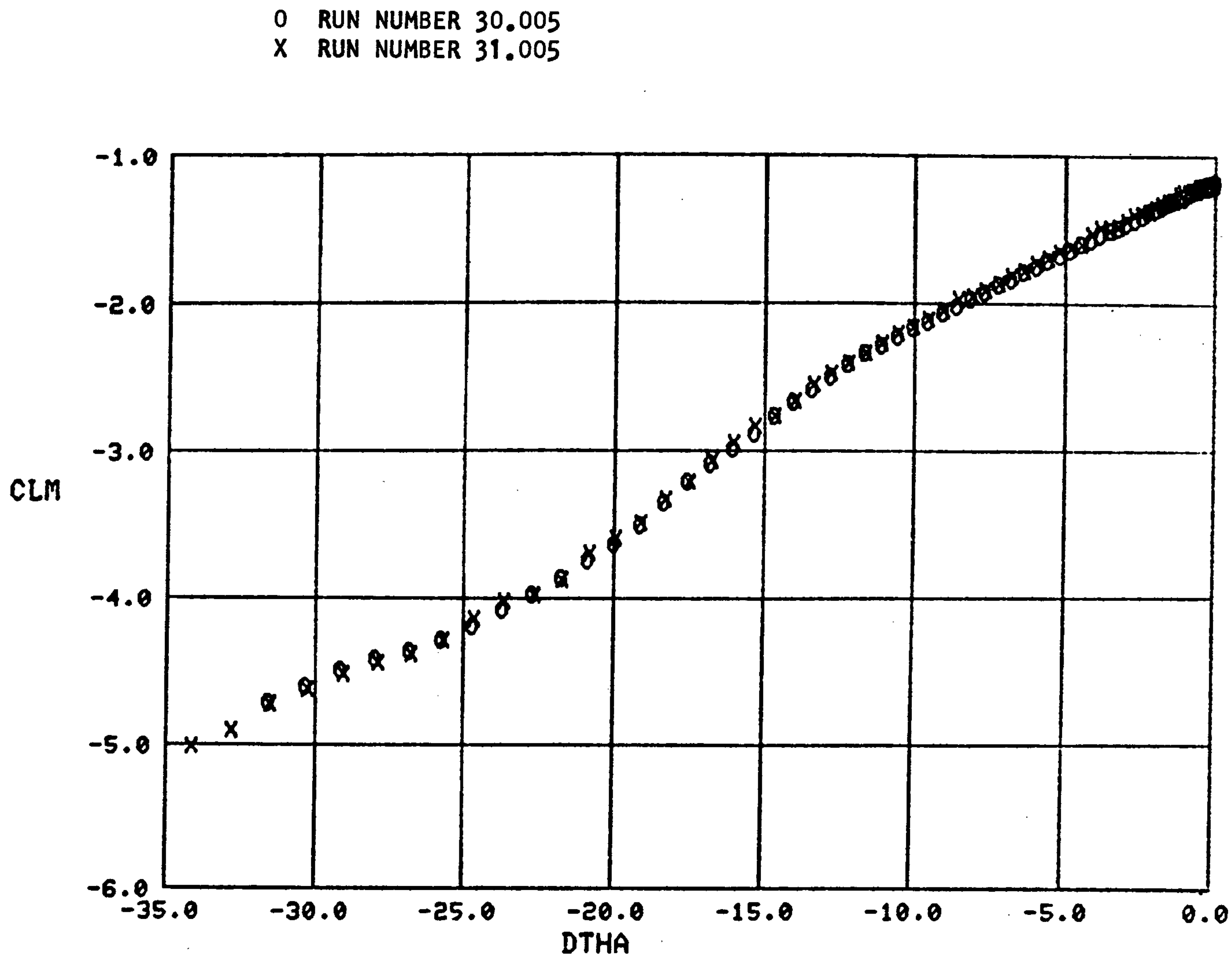


Figure 8. Examples of AMDAHL 5860 graphics plots.

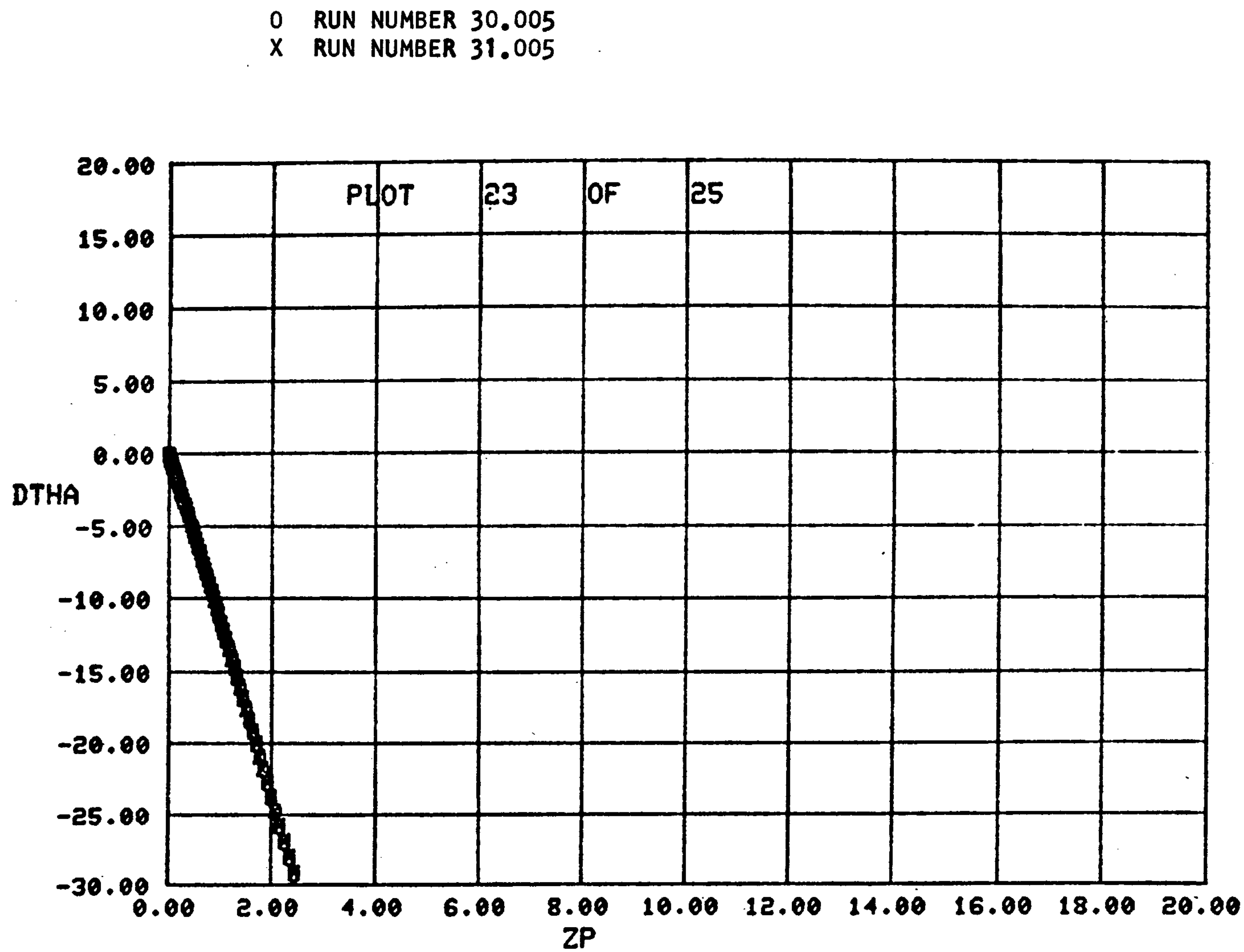


Figure 8. Concluded.

Table 1. Example of Tabulated Summary Data Format—Trajectory

RUN	TRAJ	M	PT	TT	Q	P	T	RE	TDP	SH	SCALE	H	DT	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
164	19	1.200	2032.4	55.5	844.8	838.1	400.0	4.7	-82.2	-0.0004	0.050	4.0K	0.0010	3/5/81	19:24:6	164/6	164/4	TEST TO-701

STORE	WT	A	L1	L2,L3	XCG	DXMCG	DXACG	YCG	ZCG	IXX	IXY	IXZ	IYY	IYZ	IZZ	CLP	CMQ	CNR
170	1000.0	1.069	1.167	1.167	4.208	0.000	0.000	0.000	0.042	7.4	0.0	2.4	118.5	0.0	117.3	0.0	0.0	0.0

A/C	ALPHA	BETA	NZ	DIVE	BANK	IP	IY	IR	CONFIG	WING	MOTION	NOROLL	POST	COEF	THRUST	EJECT	XFE	DXAE	OMGM	ZE1	ZE2
AWECS	3.01	0.00	1.0	0.0	0.0	0.00	0.00	0.0	1414	RIGHT	0	3	0	0	0	0	0.00	0.00	0.0	0.00	0.00

FLIGHT AXIS POSITIONS AND ORIENTATIONS — BODY AXIS FORCE AND MOMENT COEFFICIENTS

PK	T	X	Y	Z	PSI	THA	PHI	ALPHAS	BETAS	CN	CLM	CY	CLN	CLL	CAT	QA	FE1	FE2
9	0.000	-0.00	0.00	-0.33	0.00	0.01	0.0	-1.39	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.4	0.	0.
11	0.010	-0.00	0.00	-0.65	0.00	0.01	0.0	-1.37	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.4	0.	0.
13	0.020	-0.00	0.00	-0.97	0.00	0.01	0.0	-1.36	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.4	0.	0.
14	0.030	-0.00	0.00	-1.28	0.00	0.01	0.0	-1.34	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.4	0.	0.
15	0.040	-0.00	0.00	-1.59	0.00	0.01	0.0	-1.33	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.4	0.	0.
16	0.050	-0.00	0.00	-1.90	0.00	0.01	0.0	-1.32	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.3	0.	0.
17	0.060	-0.00	0.00	-2.21	0.00	0.01	0.0	-1.30	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.3	0.	0.
18	0.070	-0.00	0.00	-2.51	0.00	0.01	0.0	-1.29	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.3	0.	0.
19	0.080	-0.00	0.00	-2.80	0.00	0.01	0.0	-1.27	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.3	0.	0.
20	0.090	-0.00	0.00	-3.10	0.00	0.01	0.0	-1.26	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.3	0.	0.
21	0.100	-0.00	0.00	-3.39	0.00	0.01	0.0	-1.25	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.2	0.	0.
22	0.110	-0.00	0.00	-3.68	0.00	0.01	0.0	-1.23	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.2	0.	0.
23	0.120	-0.00	0.00	-3.96	0.00	0.01	0.0	-1.22	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.2	0.	0.
24	0.130	-0.00	0.00	-4.24	0.00	0.01	0.0	-1.20	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.2	0.	0.
25	0.140	-0.00	0.00	-4.52	0.00	0.01	0.0	-1.19	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.2	0.	0.
26	0.150	-0.00	0.00	-4.80	0.00	0.01	0.0	-1.18	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.1	0.	0.
27	0.160	-0.00	0.00	-5.07	0.00	0.01	0.0	-1.16	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.1	0.	0.
28	0.170	-0.00	0.00	-5.34	0.00	0.01	0.0	-1.15	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.1	0.	0.
29	0.180	-0.00	0.00	-5.60	0.00	0.01	0.0	-1.13	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.1	0.	0.
30	0.190	-0.00	0.00	-5.87	0.00	0.01	0.0	-1.12	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.1	0.	0.
31	0.200	-0.00	0.00	-6.12	0.00	0.01	0.0	-1.11	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.1	0.	0.
32	0.220	-0.00	0.00	-6.63	0.00	0.01	0.0	-1.08	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.0	0.	0.
33	0.240	-0.00	0.00	-7.13	0.00	0.01	0.0	-1.05	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.0	0.	0.
34	0.260	-0.00	0.00	-7.61	0.00	0.01	0.0	-1.02	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1843.0	0.	0.
35	0.280	-0.00	0.00	-8.08	0.00	0.01	0.0	-0.99	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.9	0.	0.
36	0.300	-0.00	0.00	-8.54	0.00	0.01	0.0	-0.97	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.9	0.	0.
37	0.320	-0.00	0.00	-8.98	0.00	0.01	0.0	-0.94	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.9	0.	0.
38	0.340	-0.00	0.00	-9.41	0.00	0.01	0.0	-0.91	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.8	0.	0.
39	0.360	-0.00	0.00	-9.83	0.00	0.01	0.0	-0.88	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.8	0.	0.
40	0.380	-0.00	0.00	-10.24	0.00	0.01	0.0	-0.86	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.8	0.	0.
41	0.400	-0.00	0.00	-10.63	0.00	0.01	0.0	-0.83	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.7	0.	0.
42	0.420	-0.00	0.00	-11.01	0.00	0.01	0.0	-0.80	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.7	0.	0.
43	0.440	-0.00	0.00	-11.38	0.00	0.01	0.0	-0.77	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.7	0.	0.
44	0.460	-0.00	0.00	-11.73	0.00	0.01	0.0	-0.74	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.7	0.	0.
45	0.480	-0.00	0.00	-12.07	0.00	0.01	0.0	-0.72	0.00	0.000	0.000	0.000	0.000	0.000	0.000	1842.6	0.	0.

Table 1. Continued

RUN	TRAJ	M	PT	TT	Q	P	T	RE	TCP	SH	SCALE	H	DT	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
164	19	1.200	2032.4	55.5	844.8	838.1	400.0	4.7	-80.2	-0.0004	0.050	4.0K	0.0010	3/ 5/81	19:24: 6	164/ 6	164/ 4	TEST TC-701

STORE	WT	A	L1	L2,L3	XCG	DXMCG	DXACG	YCG	ZCG	IXX	IXY	IXZ	IYY	IYZ	IZZ	CLP	CMQ	CNR
070	1000.0	1.069	1.167	1.167	4.208	0.000	0.000	0.000	0.042	7.4	0.0	2.4	118.5	0.0	117.3	0.0	0.0	0.0

A/C	ALPHA	BETA	NZ	DIVE	BANK	IP	IY	IR	CONFIG	WING	MOTION	NOROLL	PQST	COEF	THRUST	EJECT	XFE	DXAE	OMGM	ZE1	ZE2
AWACS	0.01	0.00	1.0	0.0	0.0	0.00	0.00	0.0	1414	RIGHT	0	3	0	0	0	0	0.00	0.00	0.0	0.00	0.00

FULL SCALE VELOCITIES AND ACCELERATIONS

PN	T	VX	VY	VZ	UR	U	V	W	P	Q	R	UDOT	VDOT	WDOT	PDOT	QDOT	RDOT
9	0.000	1321.2	0.0	-31.9	1321.5	0.0	0.0	-32.2	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
11	0.010	1321.2	0.0	-31.6	1321.5	-0.0	0.0	-31.9	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
13	0.020	1321.2	0.0	-31.3	1321.5	-0.0	0.0	-31.5	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
14	0.030	1321.2	0.0	-31.0	1321.5	-0.0	0.0	-31.2	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
15	0.040	1321.2	0.0	-30.7	1321.5	-0.0	0.0	-30.9	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
16	0.050	1321.2	0.0	-30.3	1321.5	-0.0	0.0	-30.6	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
17	0.060	1321.2	0.0	-30.0	1321.5	-0.0	0.0	-30.2	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
18	0.070	1321.2	0.0	-29.7	1321.5	-0.0	0.0	-29.9	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
19	0.080	1321.2	0.0	-29.4	1321.5	-0.0	0.0	-29.6	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
20	0.090	1321.2	0.0	-29.0	1321.5	-0.0	0.0	-29.3	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
21	0.100	1321.2	0.0	-28.7	1321.5	-0.0	0.0	-29.0	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
22	0.110	1321.2	0.0	-28.4	1321.5	-0.0	0.0	-28.6	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
23	0.120	1321.2	0.0	-28.1	1321.5	-0.0	0.0	-28.3	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
24	0.130	1321.2	0.0	-27.8	1321.4	-0.0	0.0	-28.0	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
25	0.140	1321.2	0.0	-27.4	1321.4	-0.0	0.0	-27.7	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
26	0.150	1321.2	0.0	-27.1	1321.4	-0.0	0.0	-27.3	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
27	0.160	1321.2	0.0	-26.8	1321.4	-0.0	0.0	-27.0	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
28	0.170	1321.2	0.0	-26.5	1321.4	-0.0	0.0	-26.7	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
29	0.180	1321.2	0.0	-26.2	1321.4	-0.0	0.0	-26.4	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
30	0.190	1321.2	0.0	-25.8	1321.4	-0.0	0.0	-26.1	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
31	0.200	1321.2	0.0	-25.5	1321.4	-0.0	0.0	-25.7	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
32	0.220	1321.2	0.0	-24.9	1321.4	-0.0	0.0	-25.1	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
33	0.240	1321.2	0.0	-24.2	1321.4	-0.0	0.0	-24.5	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
34	0.260	1321.2	0.0	-23.6	1321.4	-0.0	0.0	-23.8	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
35	0.280	1321.2	0.0	-22.9	1321.4	-0.0	0.0	-23.2	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
36	0.300	1321.2	0.0	-22.3	1321.3	-0.0	0.0	-22.5	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
37	0.320	1321.2	0.0	-21.6	1321.3	-0.0	0.0	-21.9	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
38	0.340	1321.2	0.0	-21.0	1321.3	-0.0	0.0	-21.2	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
39	0.360	1321.2	0.0	-20.4	1321.3	-0.0	0.0	-20.6	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
40	0.380	1321.2	0.0	-19.7	1321.3	-0.0	0.0	-19.9	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
41	0.400	1321.2	0.0	-19.1	1321.3	-0.0	0.0	-19.3	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
42	0.420	1321.2	0.0	-18.4	1321.3	-0.0	0.0	-18.7	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
43	0.440	1321.2	0.0	-17.8	1321.3	-0.0	0.0	-18.0	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
44	0.460	1321.2	0.0	-17.1	1321.3	-0.0	0.0	-17.4	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00
45	0.480	1321.2	0.0	-16.5	1321.3	-0.0	0.0	-16.7	0.00	0.00	0.00	-0.0	0.0	32.2	0.00	0.00	0.00

Table 1. Concluded

RUN	TRAJ	M	PT	TT	Q	P	T	RE	TDP	SH	SCALE	H	DT	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
164	19	1.200	2032.4	55.5	844.8	838.1	400.0	4.7	-82.2	-0.0004	0.050	4.0K	0.0010	3/ 5/81	19:24: 6	164/ 6	164/ 4	TEST TC-701

STORE	WT	A	L1	L2,L3	XCG	DXMCG	DXACG	YCG	ZCG	IXX	IXY	IXZ	IYY	IYZ	IZZ	CLP	CMQ	CNR
070	1000.0	1.069	1.167	1.167	4.208	0.000	0.000	0.000	0.042	7.4	0.0	2.4	118.5	0.0	117.3	0.0	0.0	0.0

A/C	ALPHA	BETA	NZ	DIVE	BANK	IP	IY	IR	CONFIG	WING	MOTION	NOROLL	POST	COEF	THRUST	EJECT	XFE	DXAE	OMGM	ZE1	ZE2
AWECS	5.01	0.00	1.0	0.0	0.0	0.00	0.00	0.0	1414	RIGHT	0	3	0	0	0	0	0.00	0.00	0.0	0.00	0.00

AIRCRAFT AXIS POSITIONS AND ORIENTATIONS

PN	T	XA	YA	ZA	DPSIA	DTHAA	DPHIA	YFS	YBL	ZWL	ALPHAAS	PHIAS	CNA	CLMA	CYA	CLNA	CLLA	CAAT
9	0.000	0.0	0.0	-0.3	0.0	0.0	0.0	38.3	2.2	3.1	1.4	180.0	0.000	0.000	0.000	0.000	0.000	0.000
11	0.010	0.0	0.0	-0.7	0.0	0.0	0.0	38.3	2.2	3.4	1.4	180.0	0.000	0.000	0.000	0.000	0.000	0.000
13	0.020	0.0	0.0	-1.0	0.0	0.0	0.0	38.3	2.2	3.8	1.4	180.0	0.000	0.000	0.000	0.000	0.000	0.000
14	0.030	0.0	0.0	-1.3	0.0	0.0	0.0	38.3	2.2	4.1	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
15	0.040	0.0	0.0	-1.6	0.0	0.0	0.0	38.3	2.2	4.4	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
16	0.050	0.0	0.0	-1.9	0.0	0.0	0.0	38.3	2.2	4.7	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
17	0.060	0.0	0.0	-2.2	0.0	0.0	0.0	38.3	2.2	5.0	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
18	0.070	0.0	0.0	-2.5	0.0	0.0	0.0	38.3	2.2	5.3	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
19	0.080	0.0	0.0	-2.8	0.0	0.0	0.0	38.3	2.2	5.6	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
20	0.090	0.0	0.0	-3.1	0.0	0.0	0.0	38.3	2.2	5.9	1.3	180.0	0.000	0.000	0.000	0.000	0.000	0.000
21	0.100	0.0	0.0	-3.4	0.0	0.0	0.0	38.3	2.2	6.2	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
22	0.110	0.0	0.0	-3.7	0.0	0.0	0.0	38.3	2.2	6.5	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
23	0.120	0.0	0.0	-4.0	0.0	0.0	0.0	38.3	2.2	6.8	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
24	0.130	0.0	0.0	-4.2	0.0	0.0	0.0	38.3	2.2	7.0	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
25	0.140	0.0	0.0	-4.5	0.0	0.0	0.0	38.3	2.2	7.3	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
26	0.150	-0.0	0.0	-4.8	0.0	0.0	0.0	38.3	2.2	7.6	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
27	0.160	-0.0	0.0	-5.1	0.0	0.0	0.0	38.3	2.2	7.9	1.2	180.0	0.000	0.000	0.000	0.000	0.000	0.000
28	0.170	-0.0	0.0	-5.3	0.0	0.0	0.0	38.3	2.2	8.1	1.1	180.0	0.000	0.000	0.000	0.000	0.000	0.000
29	0.180	-0.0	0.0	-5.6	0.0	0.0	0.0	38.3	2.2	8.4	1.1	180.0	0.000	0.000	0.000	0.000	0.000	0.000
30	0.190	-0.0	0.0	-5.9	0.0	0.0	0.0	38.3	2.2	8.7	1.1	180.0	0.000	0.000	0.000	0.000	0.000	0.000
31	0.200	-0.0	0.0	-6.1	0.0	0.0	0.0	38.3	2.2	8.9	1.1	180.0	0.000	0.000	0.000	0.000	0.000	0.000
32	0.220	-0.0	0.0	-6.6	0.0	0.0	0.0	38.3	2.2	9.4	1.1	180.0	0.000	0.000	0.000	0.000	0.000	0.000
33	0.240	-0.0	0.0	-7.1	0.0	0.0	0.0	38.3	2.2	9.9	1.1	180.0	0.000	0.000	0.000	0.000	0.000	0.000
34	0.260	-0.0	0.0	-7.6	0.0	0.0	0.0	38.3	2.2	10.4	1.0	180.0	0.000	0.000	0.000	0.000	0.000	0.000
35	0.280	-0.0	0.0	-8.1	0.0	0.0	0.0	38.3	2.2	10.9	1.0	180.0	0.000	0.000	0.000	0.000	0.000	0.000
36	0.300	-0.0	0.0	-8.5	0.0	0.0	0.0	38.3	2.2	11.3	1.0	180.0	0.000	0.000	0.000	0.000	0.000	0.000
37	0.320	-0.0	0.0	-9.0	0.0	0.0	0.0	38.3	2.2	11.8	0.9	180.0	0.000	0.000	0.000	0.000	0.000	0.000
38	0.340	-0.0	0.0	-9.4	0.0	0.0	0.0	38.3	2.2	12.2	0.9	180.0	0.000	0.000	0.000	0.000	0.000	0.000
39	0.360	-0.0	0.0	-9.8	0.0	0.0	0.0	38.3	2.2	12.6	0.9	180.0	0.000	0.000	0.000	0.000	0.000	0.000
40	0.380	-0.0	0.0	-10.2	0.0	0.0	0.0	38.3	2.2	13.0	0.9	180.0	0.000	0.000	0.000	0.000	0.000	0.000
41	0.400	-0.0	0.0	-10.6	0.0	0.0	0.0	38.3	2.2	13.4	0.8	180.0	0.000	0.000	0.000	0.000	0.000	0.000
42	0.420	-0.0	0.0	-11.0	0.0	0.0	0.0	38.3	2.2	13.8	0.8	180.0	0.000	0.000	0.000	0.000	0.000	0.000
43	0.440	-0.0	0.0	-11.4	0.0	0.0	0.0	38.3	2.2	14.2	0.8	180.0	0.000	0.000	0.000	0.000	0.000	0.000
44	0.460	-0.0	0.0	-11.7	0.0	0.0	0.0	38.3	2.2	14.5	0.7	180.0	0.000	0.000	0.000	0.000	0.000	0.000
45	0.480	-0.0	0.0	-12.1	0.0	0.0	0.0	38.3	2.2	14.9	0.7	180.0	0.000	0.000	0.000	0.000	0.000	0.000

Table 2. NOMENCLATURE FOR TRAJECTORY GENERATION TABULATED SUMMARY DATA

PAGE HEADING (ALL SUMMARIES)

<u>COMPANY HEADING</u>

DATE	Calendar time at which data were printed
PROJECT	Alpha-numeric notation for referencing a specific test project

<u>LINE 1</u>

RUN	Sequential indexing number for referencing data. A constant throughout each trajectory.
TRAJ	Configuration indexing number used to correlate data with the test log.
M	Wind tunnel free-stream Mach number
PT	Wind tunnel free-stream total pressure, psfa
TT	Wind tunnel free-stream total temperature, °R
Q	Wind tunnel free-stream dynamic pressure, psf
P	Wind tunnel free-stream static pressure, psfa
T	Wind tunnel free-stream static temperature, °R
RE	Wind tunnel free-stream unit Reynolds number, millions per foot
TDP	Hygrometer dew point temperature, °R
SH	Wind tunnel specific humidity, lbm H_2O per lbm air
SCALE	Aircraft model scale factor
H	Simulated pressure altitude, K ft
DT	Initial trajectory integration time increment, sec
DATE	Calendar time at which data were recorded
TIME	Time at which data were recorded (hr/min/sec)
CON SET	Run/point number of constants set used in data reduction
ZERO SET	Run/point number of the air off set of instrument readings used in data reduction

Table 2. Continued

TEST	Alpha-numeric notation for referencing a specific test program in a specific test unit.
<u>LINE 2</u>	
STORE	Store model designation
WT	Store full-scale weight, lb
A	Store reference area, ft^2, full scale
L1,L2,L3	Store reference lengths for pitching-moment, yawing-moment, and rolling-moment coefficients, respectively, ft, full scale
XCG	Axial distance from the store nose to the center of gravity location, ft, full scale
DXMCG,DXNCG	Axial distances from the store center of gravity to the pitching-moment and yawing-moment reference centers, respectively, positive in the positive X_B direction, ft, full scale
YCG,ZCG	Lateral and vertical distances from the store reference (balance) axis to the center of gravity location, positive in the positive Y_B and Z_B directions, respectively, ft, full scale
IXX,IYY,IZZ	Full-scale moments of inertia about the store X_B, Y_B, and Z_B axes, respectively, slug-ft^2
IXY,IXZ,IYZ	Full-scale products of inertia in the store X_B -Y_B, X_B -Z_B, and Y_B -Z_B planes, respectively, slug-ft^2
CLP,CMQ,CNR	Store roll-damping, pitch-damping, and yaw-damping derivatives, respectively, per radian
<u>LINE 3</u>	
A/C	Aircraft designation
ALPHA,BETA	Aircraft-model angle of attack and sideslip angle, respectively, deg
NZ	Aircraft load factor, g's
DIVE	Simulated aircraft dive angle, positive for decreasing altitude, deg
BANK	Simulated aircraft bank angle, positive for right wing down, deg

Table 2. Continued

IP,IY	Pitch and yaw incidence angles of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up and nose to the right, respectively, as seen by pilot, deg
IR	Roll incidence of the store Z_B-axis at carriage with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg
CONFIG	Aircraft store loading designation
WING	Location of store launch position
MOTION	Restricted motion control parameter 0 = Unrestricted motion 1 = Pivot motion, pitch only 2 = Pivot motion, pitch and yaw 3 = Pivot motion, pitch, yaw, and roll 4 = Rail motion, translate only 5 = Rail motion, translate and pitch 6 = Rail motion, translate and yaw 7 = Rail motion, translate, pitch, and yaw 8 = Pitch, translate in ejector plane only
NOROLL	CTS rig roll control parameter 0 = Rolling capability 1 = No roll capability 2 = Zero- or 6-in.-offset roll mechanisms but no roll capability 3 = No roll capability (and assume CLL=0)
POST	Launch/postlaunch control parameter 0 = Launch trajectory 1 = Postlaunch trajectory
COEF	External coefficient input control parameter 0 = No external coefficient input 1 = Constant external coefficient inputs 2 = Constant external coefficient inputs and drogue chute axial-force simulation Other = Test peculiar

Table 2. Continued

THRUST	Thrust simulation control parameter 0 = No thrust 1 = Thrust initiation at time zero 2 = Time delay for thrust initiation 3 = Lanyard and time delay for thrust initiation Other = Test peculiar thrust equations
EJECT	Ejector simulation control parameter 0 = No ejectors 1 = Time function ejector forces and cutoff control 2 = Distance function ejector forces and cutoff control 3 = Time function ejector forces and distance function cutoff Other = Test peculiar ejector functions
XFE	Axial distance from the store nose to the forward ejector piston, ft, full scale
DXAE	Distance between forward and aft ejector pistons, ft, full scale
OMGM	Ejector piston line of action with respect to store X_B $-Z_B$ plane, positive for clockwise rotation when looking upstream, deg
ZE1,ZE2	Time (distance) cutoffs for forward and aft ejectors, respectively, sec (EJECT=1) or ft, full scale (EJECT=2 or 3)

COLUMNAR HEADINGS

SUMMARY PAGE 1

PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
T	Cumulative time for the trajectory, seconds of full-scale flight time following release of store
X	Separation distance of the store cg from the flight-axis system origin in the X_F direction, ft, full scale

Table 2. Continued

Y	Separation distance of the store cg from the flight-axis system origin in the Y_F direction, ft, full scale
Z	Separation distance of the store cg from the flight-axis system origin in the Z_F direction, ft, full scale
PSI	Angle between the projection of the store longitudinal axis in the X_F-Y_F plane and the X_F-axis, positive when the store nose is to the right as seen by the pilot, deg
THA	Angle between the store longitudinal axis and its projection in the X_F-Y_F plane, positive when the store nose is raised as seen by the pilot, deg
PHI	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_F-Y_F planes, positive for clockwise rotation when looking upstream, deg
ALPHAS,BETAS	Store model angle of attack and sideslip angle, respectively, deg
CAT,CN,CY	Store measured aerodynamic axial-force, normal-force, and side-force coefficients, positive in the negative X_B, negative Z_B, and positive Y_B directions, respectively
CLL,CLM,CLN	Store measured aerodynamic rolling-moment, pitching-moment, and yawing-moment coefficients. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively
QA	Simulated full-scale dynamic pressure, psf
FE1,FE2	Forward and aft ejector forces, respectively, lb
<u>SUMMARY PAGE 2</u>	
PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
T	Cumulative time for the trajectory, seconds of full-scale flight time following release of store
VX,VY,VZ	Velocity components of the full-scale store relative to the origin of a space-fixed axis system in the positive X_B, Y_B, and Z_B directions, respectively, ft/sec

Table 2. Continued

UR	Total velocity of the full-scale store with respect to a space-fixed point, ft/sec
U,V,W	Velocities of the full-scale store relative to the origin of the inertial axis system in the positive X_B, Y_B, and Z_B directions, respectively, ft/sec
P,Q,R,	Angular velocities of the full-scale store about the X_B, Y_B, and Z_B axes. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively, rad/sec
UDOT,VDOT, WDOT	Accelerations of the full-scale store relative to the origin of the inertial axis system in the positive X_B, Y_B, and Z_B directions, respectively, ft/sec^2
PDOT,QDOT, RDOT	Angular accelerations of the full-scale store about the X_B, Y_B, and Z_B axes. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively, rad/sec^2
<u>SUMMARY PAGE 3</u>	
PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
T	Cumulative time for the trajectory, seconds of full-scale flight time following release of store
XA	Separation distance of the store cg with respect to the flight-axis system origin in the X_A direction, ft, full scale
YA	Separation distance of the store cg with respect to the flight-axis system origin in the Y_A direction, ft, full scale
ZA	Separation distance of the store cg with respect to the flight-axis system origin in the Z_A direction, ft, full scale
DPSIA	Angle between the projection of the store longitudinal axis in the X_A-Y_A plane and X_A-axis, positive for store nose to the right as seen by the pilot, deg
DTHAA	Angle between the store longitudinal axis and its projection in the X_A-Y_A plane, positive when the store nose is raised as seen by the pilot, deg

Table 2. Continued

DPHIA	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_A-Y_A planes, positive for clockwise rotation when looking upstream, deg
XFS	Separation distance of the store cg with respect to aircraft fuselage station zero in the negative X_A direction, ft, full scale
YBL	Separation distance of the store cg with respect to aircraft buttock line zero in the Y_A direction, ft, full scale
ZWL	Separation distance of the store cg with respect to aircraft waterline zero in the negative Z_A direction, ft, full scale
ALPHAAS	Store model total (aeroballistic) angle of attack, angle between the body X_B-axis and the free-stream wind X-axis, always positive, deg
PHIAS	Aerodynamic roll angle, angle between the aeroballistic Y_a-axis and the body Y_B-axis, positive clockwise looking upstream, deg
CAAT,CNA,CYA	Aeroballistic axis axial-force, normal-force, and side-force coefficients, positive in the aeroballistic axis negative X_a, negative Z_a, and positive Y_a directions, respectively
CLLA,CLMA,CLNA	Aeroballistic axis rolling-moment, pitching-moment, and yawing-moment coefficients. The positive vectors are coincident with the aeroballistic axis positive X_a, Y_a, and Z_a directions, respectively

STORE BODY AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_B	Parallel to the store longitudinal axis, positive direction is upstream at store release
Y_B	Perpendicular to X_B and Z_B directions, positive to the right looking upstream when the store is at zero yaw and roll angles
Z_B	Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Table 2. Continued

Origin

The store body-axis system origin is coincident with the store cg at all times. The X_B, Y_B, and Z_B coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

FLIGHT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_F	Parallel to the current aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the current aircraft flight path direction, positive downward as seen by the pilot

Origin

The flight-axis system origin is coincident with the store cg at release. The origin is fixed with respect to flight path at the free-stream velocity. The coordinate axes rotate to maintain alignment of the X_F-axis with the current aircraft-flight path direction.

AIRCRAFT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_A	Parallel to the aircraft longitudinal axis at store release and at constant angular orientation with respect to the current aircraft flight path direction, positive forward as seen by the pilot
Y_A	Perpendicular to the X_A directions and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot
Z_A	Perpendicular to the X_A and Y_A directions, positive downward as seen by the pilot

Table 2. Conlcuded

Origin

The aircraft-axis system origin is coincident with the flight-axis system origin and the store cg at release. It is fixed with respect to the aircraft and thus translates along the current aircraft flight path at the free-stream velocity. The coordinate axes rotate to maintain constant angular orientation with respect to the current aircraft flight path direction.

AEROBALLISTIC-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_a	Parallel to the store longitudinal axis, positive direction is upstream at store release
Y_a	Perpendicular to the X_B direction and the plane of total angle of attack, positive to the right looking upstream when both PHI and PHIAS are zero
Z_a	Perpendicular to the X_B direction and contained in the plane of total angle of attack, positive downward looking upstream when both PHI and PHIAS are zero.

Origin

The aeroballistic-axis system origin is coincident with the store cg at all times.

Table 3. Example of Tabulated Summary Data Format—Aerodynamic Grid

RUN	SURVEY	M	PT	TT	Q	P	T	V	RE	TDP	SH	SCALE	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
162	101	0.028	2035.7	76.0	100.0	2034.6	535.6		31.916.4	-73.9	-0.0002	0.050	11/27/79	21:52:17	161/ 5	161/ 1	TEST TC-635

A/C F/S	ALPHA	BETA	IP	IY	IR	CONFIG	WING	STORE	A	L1	L2,L3	XCG	YCG	ZCG	PHIS
	0.00	0.00	0.00	0.00	0.0	1	FUSCL	MK-83	1.069	1.167	1.167	4.042	0.000	0.000	45.0

	REFERENCE AXIS								BODY AXIS COEFFICIENTS									
PN	XREF	YREF	ZREF	DPSI	DTHA	DPHI	ALPHAS	BETAS	CN	CLM	CY	CLN	CLL	CAT	Q	NDX	RUN	PHIREF
2	-0.02	-0.01	0.01	-0.01	7.98	-0.0	7.98	0.01	-0.015	0.062	-0.095	0.091	-0.009	0.048	100.0	17	162	0
3	-0.03	-0.00	-0.02	-0.00	4.01	0.0	4.01	0.00	-0.012	0.066	-0.084	0.082	-0.003	0.057	100.0	18	162	0
4	-0.01	0.00	-0.02	-0.00	2.00	0.0	2.00	0.00	-0.008	0.068	-0.095	0.091	-0.008	0.047	100.0	19	162	0
5	-0.02	0.00	-0.02	0.01	1.01	0.0	1.01	-0.01	-0.014	0.067	-0.095	0.091	-0.008	0.056	100.0	20	162	0
6	0.00	0.00	-0.02	0.00	0.01	0.0	0.01	-0.00	-0.015	0.066	-0.095	0.091	-0.004	0.079	100.0	21	162	0
7	0.01	0.00	-0.02	0.00	-0.99	0.0	-0.99	-0.00	-0.014	0.066	-0.089	0.081	-0.002	0.074	100.0	22	162	0
8	-0.00	0.00	-0.02	-0.00	-1.99	0.0	-1.99	0.00	-0.014	0.066	-0.095	0.091	-0.002	0.083	100.0	23	162	0
9	-0.00	0.00	-0.02	0.01	-4.00	0.0	-4.00	-0.01	-0.018	0.076	-0.089	0.093	-0.001	0.101	100.0	24	162	0
10	-0.01	-0.00	-0.04	-0.00	-7.96	0.0	-7.96	0.00	-0.015	0.072	-0.089	0.093	-0.000	0.081	100.0	25	162	0
11	-0.00	0.00	-0.05	-0.00	-11.95	0.0	-11.95	0.00	-0.013	0.065	-0.089	0.093	0.000	0.090	100.0	26	162	0
12	-0.00	0.00	-0.04	0.00	-15.96	0.0	-15.96	-0.00	-0.000	0.058	-0.084	0.083	0.001	0.087	100.0	27	162	0
13	0.00	0.00	-0.03	0.01	-19.97	-0.0	-19.97	-0.01	-0.016	0.066	-0.083	0.083	0.002	0.098	100.0	28	162	0
14	-0.01	0.00	-0.02	-0.00	-23.96	0.0	-23.96	0.00	-0.020	0.063	-0.089	0.094	-0.002	0.097	100.0	29	162	0
15	-0.01	0.00	-0.02	0.00	-27.97	-0.0	-27.97	-0.00	-0.026	0.068	-0.083	0.083	-0.002	0.085	100.0	30	162	0
16	-0.01	-0.00	-0.02	-0.00	-31.97	0.0	-31.97	0.00	-0.021	0.062	-0.089	0.094	-0.001	0.103	100.0	31	162	0
17	-0.02	-0.00	-0.02	-0.00	-35.97	0.0	-35.97	-0.00	-0.017	0.065	-0.078	0.085	0.000	0.109	100.0	32	162	0
18	-0.01	0.00	-0.01	0.00	-39.99	-0.0	-39.99	-0.00	-0.020	0.064	-0.089	0.094	0.001	0.105	100.0	33	162	0

Table 3. Concluded

RUN	SERVEY	M	PT	TT	Q	P	T	V	RE	IDP	SH	SCALE	DATE	TIME	CON SET	ZERO SET	TRANSONIC 4T
8	204	0.024	2044.7	61.8	100.0	2043.9	521.4	27.2	19.6	-74.0	-0.0002	0.050	11/26/79	19/44/19	8/ 11	8/ 1	TEST TC-635

A/C	ALPHA	BETA	IP	IY	IR	CONFIG	WING	STORE	A	L1	L2,L3	XCG	YCG	ZCG	PHIS
F-4E	5.95	0.00	-1.00	0.00	0.0	2	FUSCL	MK-83	1.069	1.167	1.167	4.042	0.000	0.000	45.0

PYLON AXIS — DELTA COEFFICIENTS

PN	XP	YP	ZP	DPSI	DTHA	DPHI	ALPHAS	BETAS	DCN	DCLM	DCY	DCLN	DCLL	DCAT	Q	NDX	RUN
15	0.00	-0.02	-0.04	-0.00	0.04	-0.0	4.99	0.00	2.215	-0.595	-0.017	0.038	0.010	0.005	100.0	1	8
17	-0.01	-0.02	0.48	-0.00	0.01	-0.0	4.96	0.00	2.209	-0.585	-0.023	0.036	0.005	-0.023	100.0	2	8
18	-0.00	-0.02	0.98	-0.00	0.01	-0.0	4.96	0.00	2.215	-0.596	-0.012	0.027	0.010	-0.009	100.0	3	8
19	-0.00	-0.03	1.97	-0.00	0.02	-0.0	4.97	0.00	2.221	-0.594	-0.012	0.027	0.005	-0.023	100.0	4	8
20	0.00	-0.02	2.98	-0.00	0.01	-0.0	4.96	0.00	2.215	-0.596	-0.006	0.016	0.010	-0.009	100.0	5	8
21	-0.00	-0.02	3.98	-0.00	0.02	-0.0	4.97	0.00	2.215	-0.596	-0.012	0.027	0.010	-0.023	100.0	6	8
22	-0.01	-0.03	5.98	-0.00	0.02	-0.0	4.97	0.00	2.210	-0.585	-0.011	0.027	0.005	-0.023	100.0	7	8
23	-0.01	-0.02	7.98	-0.00	0.01	-0.0	4.96	0.00	2.215	-0.596	-0.012	0.027	0.005	-0.023	100.0	8	8
24	0.00	-0.03	9.98	-0.00	0.01	-0.0	4.96	0.00	2.215	-0.596	-0.017	0.026	0.010	-0.023	100.0	9	8
25	-0.00	-0.02	11.98	-0.00	0.02	-0.0	4.97	0.00	2.210	-0.585	-0.017	0.025	0.010	-0.023	100.0	10	8
26	-0.00	-0.03	13.98	-0.00	0.02	-0.0	4.97	0.00	2.215	-0.596	-0.017	0.026	0.005	-0.023	100.0	11	8
27	-0.00	-0.02	15.99	-0.00	0.01	-0.0	4.96	0.00	2.204	-0.598	-0.017	0.025	0.005	-0.009	100.0	12	8
28	-0.01	-0.03	17.99	-0.00	0.01	-0.0	4.96	0.00	2.221	-0.606	-0.012	0.027	0.010	-0.009	100.0	13	8

Table 4. NOMENCLATURE FOR AERODYNAMIC GRID TABULATED SUMMARY DATA

PAGE HEADINGS (COMMON TO ALL SUMMARIES)

<u>COMPANY HEADINGS</u>

DATE	Calendar time at which the data were printed
PROJECT	Alpha-numeric notation for referencing a specific test project

<u>LINE 1</u>

RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.
SURVEY	Configuration indexing number used to correlate data with the test log. Survey may be used to identify all or portions of a grid set.
M	Wind tunnel free-stream Mach number
PT	Wind tunnel free-stream total pressure, psfa
TT	Wind tunnel free-stream total temperature, °R
Q	Wind tunnel free-stream dynamic pressure, psfa
P	Wind tunnel free-stream static pressure, psfa
T	Wind tunnel free-stream static temperature, °R
V	Wind tunnel free-stream velocity, ft/sec
RE	Wind tunnel free-stream unit Reynolds number, millions per foot
TDP	Hygrometer dew point temperature, °R
SH	Wind tunnel specific humidity, lbm H_2O per lbm air
SCALE	Aircraft model scale factor
DATE	Calendar time at which data were recorded
TIME	Time at which data were recorded (hr/min/sec)
CON SET	Run/point number of constants set used in data reduction
ZERO SET	Run/point number of the air-off set of instrument readings used in data reduction

Table 4. Continued

TEST	Alpha-numeric notation for referencing a specific test program in a specific test unit.

LINE 2

A/C	Aircraft designation
ALPHA,BETA	Aircraft-model angle of attack and sideslip angle, respectively, deg
IP,IY	Pitch and yaw incidence angles of the store longitudinal axis at carriage with respect to the aircraft longitudinal axis, positive nose up and nose to the right, respectively, as seen by pilot, deg
IR	Roll incidence of the store Z_B-axis at carriage with respect to the aircraft plane of symmetry, positive for clockwise roll looking upstream, deg
CONFIG	Aircraft store loading designation
WING	Location of store launch position
STORE	Store model designation
A	Store reference area, ft^2, full scale
L1,L2,L3	Store reference lengths for pitching-moment, yawing-moment, and roll-moment coefficients, respectively, ft, full scale
XCG	Axial distance from the store nose to the center of gravity location, ft, full scale
YCG,ZCG	Lateral and vertical distances from the store reference (balance) axis to the center of gravity location, positive in the positive Y_B and Z_B directions, respectively, ft, full scale
PHIS	Roll angle of the store Number 1 fin with respect to the negative Z_B-axis, positive clockwise looking upstream, deg

COLUMNAR HEADINGS

SUMMARY PAGE 1

PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.

Table 4. Continued

XREF	Position of the store cg with respect to the reference-axis system origin in the X_{REF} direction, ft, full scale
YREF	Position of the store cg with respect to the reference-axis system origin in the Y_{REF} direction, ft, full scale
ZREF	Position of the store cg with respect to the reference-axis system origin in the Z_{REF} direction, ft, full scale
DPSI	Angle between the projection of the store longitudinal axis in the X_P-Y_P plane and the X_P-axis, positive for store nose to the right as seen by the pilot, deg
DTHA	Angle between the store longitudinal axis and its projection in the X_P-Y_P plane, positive when the store nose is raised as seen by the pilot, deg
DPHI	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_P-Y_P planes, positive for clockwise rotation when looking upstream, deg
ALPHAS, BETAS	Store model angle of attack and sideslip angle, respectively, deg
CAT,CN,CY	Store measured aerodynamic axial-force, normal-force, and side-force coefficients, positive in the negative X_B, negative Z_B, and positive Y_B direction, respectively
CLL,CLM,CLN	Store measured aerodynamic rolling-moment, pitching-moment, and yawing-moment coefficients. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively.
Q	Wind tunnel free-stream dynamic pressure, psf
NDX	Sequential indexing number for referencing data obtained during a grid set. Indexes for each position in the set
RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey.
PHIREF	Angle between the Y_{REF} axis and the ________ plane, positive for clockwise rotation when looking upstream, deg

Table 4. Continued

INTERFERENCE COEFFICIENT NOMENCLATURE (TYPICAL)

COLUMNAR HEADINGS

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PN	Sequential indexing number for referencing data obtained during one run. Indexes each time a new set of data inputs is obtained.
XP,YP,ZP	Position of the store cg with respect to the pylon-axis system origin in the X_P, Y_P, and Z_P directions, respectively, ft, full scale
DPSI	Angle between the projection of the store longitudinal axis in the X_P-Y_P plane and the X_P-axis, positive for store nose to the right as seen by the pilot, deg
DTHA	Angle between the store longitudinal axis and its projection in the X_P-Y_P plane, positive when the store nose is raised as seen by the pilot, deg
DPHI	Angle between the store lateral (Y_B) axis and the intersection of the Y_B-Z_B and X_P-Y_P planes, positive for clockwise rotation when looking upstream, deg
ALPHAS, BETAS	Store model angle of attack and sideslip angle, respectively, deg
DCAT,DCN, DCY	Store calculated aerodynamic axial-force, normal-force, and side-force flow-field influence coefficients, difference in measured coefficient values in the aircraft flow field and the free stream at comparable attitude, positive in the negative X_B, negative Z_B and positive Y_B directions, respectively
DCLL,DCLM, DCLN	Store calculated aerodynamic rolling-moment, pitching-moment and yawing-moment flow-field influence coefficients, difference in measured coefficient values in the aircraft flow field and the free stream at comparable attitude. The positive vectors are coincident with the positive X_B, Y_B, and Z_B axes, respectively
Q	Wind tunnel free-stream dynamic pressure, psf
NDX	Sequential indexing number for referencing data obtained during a grid set. Indexes for each position in the set
RUN	Sequential indexing number for referencing data. A constant throughout specified (or all) points of a survey

Table 4. Continued

REFERENCE-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_{REF}	Parallel to the _____ direction, positive forward as seen by the pilot
Y_{REF}	Perpendicular to the X_{REF} direction and rotated through an angle ϕ_{REF} with respect to the _____ direction, positive to the right as seen by the pilot for zero rotation angle
Z_{REF}	Perpendicular to the X_{REF} and Y_{REF} directions, positive downward as seen by the pilot for zero rotation of the Y_{REF} axis

Origin

The reference-axis system origin may be arbitrarily chosen and is determined from the set of initial position coordinates input at the initialization of the grid set. It is fixed with respect to the aircraft for the duration of the grid set. For this test, origin coordinates and ϕ_{REF} angles are defined as follows:

STORE BODY-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_B	Parallel to the store longitudinal axis, positive direction is upstream at store release
Y_B	Perpendicular to X_B and Z_B directions, positive to the right looking upstream when the store is at zero yaw and roll angles
Z_B	Perpendicular to the X_B direction and parallel to the aircraft plane of symmetry when the store and aircraft are at zero yaw and roll angles, positive downward as seen by the pilot when the store is at zero pitch and roll angles

Origin

The store body-axis system origin is coincident with the store cg at all time. The X_B, Y_B, and Z_B coordinate axes rotate with the store in pitch, yaw, and roll so that mass moments of inertia about the three axes are not time-varying quantities.

Table 4. Concluded

PYLON-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_P	Parallel to the store longitudinal axis at carriage, positive forward as seen by the pilot
Y_P	Perpendicular to the X_P direction and parallel to the X_F-Y_F plane, positive to the right as seen by the pilot
Z_P	Perpendicular to the X_P and Y_P directions, positive downward as seen by the pilot

Origin

The pylon-axis system origin is coincident with the reference-axis system origin.

FLIGHT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_F	Parallel to the aircraft flight path direction, positive forward as seen by the pilot
Y_F	Perpendicular to the X_F and Z_F directions, positive to the right as seen by the pilot
Z_F	Parallel to the aircraft plane of symmetry and perpendicular to the aircraft flight path direction, positive downward as seen by the pilot

Origin

The flight-axis system origin is coincident with the reference-axis system origin.

AIRCRAFT-AXIS SYSTEM DEFINITIONS

Coordinate Directions

X_A	Parallel to the aircraft longitudinal axis, positive forward as seen by the pilot
Y_A	Perpendicular to the aircraft plane of symmetry, positive to the right as seen by the pilot
Z_A	Perpendicular to the X_A and Y_A directions, positive downward as seen by the pilot

Origin

The aircraft-axis system origin is coincident with the reference-axis system origin.

Table 5. Trajectory Data Tape Details

MAGNETIC TAPE INFORMATION
PROPULSION WIND TUNNEL

1. TEST NO. TC-701 PROJECT NO. P41B-19
2. TEST TITLE AD/ROCKWELL LOW LEVEL Delivery
3. THE COMPUTER USED TO WRITE THE TAPE(S) AMDAHL 5860
4. THE TAPE(S) IS ✓ BCD (FORMATED) ____ BINARY (UNFORMATED)
5. THE TAPES ARE ____ SEVEN ✓ NINE TRACK AT A DENSITY OF 800 BPI.
6. THE FORMAT USED TO WRITE THE TAPE(S) WAS (BCD TAPES ONLY) 1P10E12.5
7. THE TAPE(S) IS ____ BLOCKED ✓ UNBLOCKED
8. EACH TEST POINT CONSISTS OF 5 PHYSICAL RECORD(S) AND EACH PHYSICAL RECORD CONSISTS OF 1 LOGICAL RECORD(S)
9. ONE TEST POINT CONSISTS OF 50 VARIABLES
10. THERE IS AN END-OF-FILE MARK AT ✓ END OF DATA ON EACH TAPE; ____ END OF LAST TAPE ONLY
11. THE PERSON(S) TO CONTACT IF YOU NEED MORE INFORMATION:

    PROGRAMMER G.D. WELLS/C. Bean PHONE (615-455-2611, Ext. 7762)

    PROJ. ENGR. JACK CARMAN PHONE (615-455-2611, Ext. 7134)
12. ATTACHED IS A LIST OF VARIABLES THAT MAKE UP EACH TEST POINT IN THE ORDER THAT THEY APPEAR ON THE TAPE(S). THE NOMENCLATURE OF THE VARIABLES IS THE SAME AS THE PRINTED DATA
13. THE TOTAL NUMBER OF TAPES 1
14. THE 'JCL' CARDS USED TO WRITE THE TAPE(S) WERE:

```
// GO.FT11F001 DD UNIT=2400, DISP=(,PASS),
// VOL=(,RETAIN), DSN=TRAJ, LABEL=(,BLP),
// DCB=(RECFM=F, LRECL=120, DEN=2, BLKSIZE=120)
```

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Table 5. Concluded

DATA TAPE VARIABLE LIST [TEST NO. TC-701 / PROJECT NO. P41B-19] Trajectory DATA

TAPE NO. ______, DS NAME ______, ______-TRACK

FORMAT ______, ______ VARIABLES/POINT

VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME
1	TEST			31	CY				
2	RUN			32	CLN				
3	PN			33	CLL				
4	M			34	CAT				
5	Q			35	CNA				
6	RE			36	CLMA				
7	CONFIG			37	CYA				
8	ALPHA			38	CLNA				
9	BETA			39	CLLA				
10	ALPHAS			40	CAAT				
11	BETAS			41	TIME				
12	ALPHAAS			42	BLANK				
13	PHIAS			43					
14	X			44					
15	Y			45					
16	Z			46					
17	PSI			47					
18	THA			48					
19	PHI			49					
20	XA			50					
21	YA								
22	ZA								
23	DPSIA								
24	DTHAA								
25	DPHIA								
26	XFS								
27	YBL								
28	ZWL								
29	CN								
30	CLM								

Table 6. Aerodynamic Grid Data Tape Details

MAGNETIC TAPE INFORMATION

PROPULSION WIND TUNNEL

1. TEST NO. TC-123 PROJECT NO. P41B-00
2. TEST TITLE AD F-16 Pave Cove CTS Test
3. THE COMPUTER USED TO WRITE THE TAPE(S) AMDAHL 5860
4. THE TAPE(S) IS ✓ BCD (FORMATED) ____ BINARY (UNFORMATED)
5. THE TAPES ARE ____ SEVEN ✓ NINE TRACK AT A DENSITY OF 1600 BPI.
6. THE FORMAT USED TO WRITE THE TAPE(S) WAS (BCD TAPES ONLY) 1P50E12.5
7. THE TAPE(S) IS ____ BLOCKED ✓ UNBLOCKED
8. EACH TEST POINT CONSISTS OF 1 PHYSICAL RECORD(S) AND EACH PHYSICAL RECORD CONSISTS OF 1 LOGICAL RECORD(S)
9. ONE TEST POINT CONSISTS OF 50 VARIABLES
10. THERE IS AN END-OF-FILE MARK AT ✓ END OF DATA ON EACH TAPE; ____ END OF LAST TAPE ONLY
11. THE PERSON(S) TO CONTACT IF YOU NEED MORE INFORMATION:

    PROGRAMMER C.F. Bearden PHONE (615-455-2611, Ext. 7515)

    PROJ. ENGR. J.B. Carman PHONE (615-455-2611, Ext. 7194)
12. ATTACHED IS A LIST OF VARIABLES THAT MAKE UP EACH TEST POINT IN THE ORDER THAT THEY APPEAR ON THE TAPE(S). THE NOMENCLATURE OF THE VARIABLES IS THE SAME AS THE PRINTED DATA
13. THE TOTAL NUMBER OF TAPES 1
14. THE 'JCL' CARDS USED TO WRITE THE TAPE(S) WERE:

```
// GO.FT11F001 DD UNIT=2400, DISP=(,PASS),
// VOL=(,RETAIN), DSN=GRID, LABEL=(,BLP),
// DCB=(RECFM=F, LRECL=120, DEN=2, BLKSIZE=120)
```

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Table 6. Concluded

DATA TAPE VARIABLE LIST [TEST NO. TC-123 / PROJECT NO. P41B-00] GRID DATA

TAPE NO. ________, DS NAME ________, ________-TRACK

FORMAT ________, ________ VARIABLES/POINT

VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME	VAR. NO.	VARIABLE NAME
1	Test			31	XA				
2	RUN			32	YA				
3	Point			33	ZA				
4	Date			34	DPSIA				
5	M			35	DTHAA				
6	RE			36	DPHIA				
7	ALPHA			37	F/S RUN				
8	BETA			38	ALPHAS F/S				
9	CONFIG			39	SPARE				
10	ALPHAS			40					
11	BETAS			41					
12	CN			42					
13	CLM			43					
14	CY			44					
15	CLN			45	DCN				
16	CLL			46	DCLM				
17	CAT			47	DCY				
18	X			48	DCLN				
19	Y			49	DCLL				
20	Z			50	DCAT				
21	PSI								
22	THA								
23	PHI								
24	Q								
25	XP								
26	YP								
27	ZP								
28	DPSI								
29	DTHA								
30	DPHI								